California Regional Water Quality Control Board
San Francisco Bay Region

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April 5, 2002

NOTICE OF A PUBLIC HEARING AND

NOTICE OF FILING A DRAFT ENVIRONMENTAL DOCUMENT

In the Matter of a Proposed Amendment
to the Water Quality Control Plan for the San Francisco Bay Basin

NOTICE IS HEREBY GIVEN that the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB), will consider for adoption an amendment to the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan). The proposed amendment would:

1) Establish site-specific chronic and acute water quality objectives for dissolved concentrations of copper and nickel in the portion of San Francisco Bay South of the Dumbarton Bridge, referred to as Lower South San Francisco Bay;

2) Detail the implementation plan to achieve and support these site-specific water quality objectives; and

3) Revise portions of Chapter 4 (Implementation Plan) of the Basin Plan pertaining to Lower South San Francisco Bay.

Action on the proposed amendment will be taken in accordance with a regulatory program exempt under Section 21080.5 of the Public Resources Code from the requirement to prepare an environmental impact report under the California Environmental Quality Act (Public Resources Code Section 2100 et seq.) and with other applicable laws and regulations.

The public hearing to discuss the proposed Basin Plan amendment will be held:

DATE:	Wednesday, May 22, 2002
TIME:	During the RWQCB's regular meeting, which begins at 9:00 a.m.
LOCATION:	Elihu M. Harris State Building First Floor Auditorium 1515 Clay Street Oakland, California 94612
STAFF CONTACT:	Richard Looker, M. Eng., P.E. Water Resources Control Engineer Phone: 510-622-2451 Fax: 510-622-2460 Email: rel@rb2.swrcb.ca.gov

The public hearing will be conducted in accordance with 23 Cal. Code of Regs. § 649.3. Time limits may be imposed on oral testimony at the public hearing; groups are encouraged to designate a spokesperson. All exhibits presented at the hearing, including charts, graphs, and other testimony must be left with the RWQCB as they will become part of the administrative record.

At the conclusion of the public hearing, the RWQCB will consider adoption of the proposed amendment, or changes to the proposed amendment consistent with the general purpose of the proposed Basin Plan amendment that are a result of logical outgrowth of the testimony received.

Attached is the staff report that serves as the environmental document functionally equivalent to CEQA requirements and the draft Basin Plan amendment (Appendix A). The environmental checklist can be downloaded from the RWQCB Web site at http://www.swrcb.ca.gov/~rwqcb2/download.htm. Copies are also available at the RWQCB offices. Further information and copies may also be obtained by contacting the staff contact above.

All evidence, testimony (except rebuttal testimony) and exhibits proposed to be offered at the hearing must be submitted in writing (email preferred) to the RWQCB staff contact identified above no later than May 7, 2002 in order to be considered by the RWQCB. Oral testimony offered at the hearing that goes beyond the scope of the written testimony may be excluded. Copies of general vicinity maps or large, non-technical photographs are not required to be submitted prior to the hearing. Non-evidentiary policy statements to be made at the hearing need not be submitted in advance. RWQCB staff will respond to timely submitted comments.

A map and directions to the hearing are available on the RWQCB web site at http://www.swrcb.ca.gov/~rwqcb2/direction.htm. The location of the hearing is accessible to persons with disabilities. Individuals who require special accommodations are requested to contact the Executive Assistant at least 5 working days before the meeting. TTY users may contact the California Relay Service at 1-800-735-2929 or voice line at 1-800-735-2922.

Thank you for your interest in the Basin Plan and the protection of water quality.

Attachment

STAFF REPORT ON PROPOSED SITE-SPECIFIC WATER QUALITY OBJECTIVES AND WATER QUALITY ATTAINMENT STRATEGY FOR COPPER AND NICKEL FOR SAN FRANCISCO BAY SOUTH OF THE DUMBARTON BRIDGE

San Francisco Bay Regional Water Quality Control Board

Document For Public Comment

April 5, 2002

Table of Contents

1 Introduction

This staff report provides the background and basis for the proposed amendments to the Water Quality Control Plan, San Francisco Bay Region ("Basin Plan"). If adopted by the Board, the amendments to the Basin Plan described in this report would 1) establish site-specific chronic and acute water quality objectives for dissolved concentrations of copper and nickel in San Francisco Bay, south of the Dumbarton Bridge ("Lower South SF Bay"), and 2) detail the implementation plans to support these site-specific water quality objectives ("SSOs"). Thus, portions of Chapter 3 (Water Quality Objectives), and Chapter 4 (Implementation Plan) of the Basin Plan would be revised. Chapter 4 of the Basin Plan would also be amended to include the implementation plan developed to safeguard against degradation of existing water quality despite relaxing the water quality objectives. The proposed amendments include other updates and changes to the Basin Plan language that would be necessitated by the adoption of the SSOs.

The proposed SSOs are higher than the water quality objectives that currently apply in Lower South SF Bay, but they were derived through USEPA-approved methods (USEPA, 1994) and are fully protective of the aquatic life beneficial uses in Lower South SF Bay. Although the proposed Amendment relaxes the copper and nickel water quality objectives, the implementation plan to maintain the objectives contains strong pollution prevention and source control actions designed to prevent any increases in ambient concentrations of copper and nickel.

This report will also describe the necessity for other changes in Basin Plan language relating to San Francisco Bay Regional Water Quality Control Board ("Regional Board" or "RWQCB") strategies in Lower South SF Bay. This staff report presents an argument to demonstrate why SSOs are necessary in Lower South SF Bay through a discussion of background conditions and the nature of current loading to this segment of the Bay. This report will also provide a summary of information demonstrating that the proposed SSOs are fully protective of beneficial uses of Lower South SF Bay.

In addition, this report contains the analyses required to establish water quality objectives under Section 13241 of the Porter-Cologne Water Quality Control Act (California Water Code Section 13241). It also contains a full description, including time schedule and surveillance, of the implementation program to achieve and maintain the SSOs, as required under California Water Code Section 13242. This report also includes analyses demonstrating compliance with State and federal antidegradation requirements.

This staff report also serves to meet the requirements of the California Environmental Quality Act (CEQA) for adopting basin plan amendments. CEQA authorizes the Resources Agency Secretary to exempt a State agency regulatory program from preparing an Environmental Impact Report, Negative Declaration, and Initial Studies if certain conditions are met. The Resources Agency has certified the basin planning process to be "functionally equivalent" to the CEQA process (Title 22, California Code of Regulations, Section 15251(g)). Therefore, this report is the Functional Equivalent Document and fulfills the requirements of CEQA for preparation of an environmental document. The environmental impacts that may occur as a result of the proposed action are discussed herein and in the Environmental Checklist Form provided in the administrative record for this amendment.

2 Regulatory Authority

A water quality standard defines the water quality goals of a water body by designating the use or uses to be made of the water, by setting the numeric or narrative water quality objectives necessary to protect the uses, and by preventing degradation of water quality through antidegradation provisions (USEPA, 1994). Clean Water Act Section 303(c) requires states to adopt and modify as appropriate water quality standards (of which water quality objectives are a component) for surface waters that protect the public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act (33 U.S.C. Section 1313(c)). Water quality objectives must be based on sound scientific rationale and protect the designated beneficial uses of the receiving water (40 CFR 131.11). California Water Code Section 13240 additionally authorizes regional boards to adopt water quality objectives that reasonably protect beneficial uses and prevent nuisance based on factors listed in Section 13241.

The current water quality objectives that apply to copper and nickel of Lower South SF Bay are from the California Toxics Rule ("CTR", 40 CFR 131.38 et seq) promulgated by USEPA in May 2000. The State Water Resources Control Board's ("State Board") Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries ("State Implementation Policy" or "SIP") allows a regional board to adopt SSOs in lieu of the objectives in the CTR whenever it determines, in the exercise of its professional judgment, that it is appropriate to do so. The regulations promulgated under the Clean Water Act also allow states to adopt water quality criteria based on Clean Water Act Section 304(a) guidance to reflect site-specific conditions.

Based on the foregoing, and as more fully explained below, the Regional Board staff has determined, in the exercise of its professional judgment and consideration of site-specific conditions in the Lower South SF Bay, that the proposed dissolved copper and nickel SSOs for the Lower South SF Bay are appropriate in lieu of the CTR criteria. The SSOs fully comply with State and federal laws and regulations for adopting water quality objectives, as explained in this staff report.

3 Background and Existing Conditions

3.1 Physical Setting

Lower South SF Bay is located in San Francisco Bay along the northern part of California's central coastline. For the purposes of this study, Lower South SF Bay is the approximately 15 square mile region of the San Francisco Bay estuary located south of the Dumbarton Bridge. Lower South SF Bay is bordered by the Silicon Valley, the center of the high technology electronics industry. In the 1960's, the boom of the electronics industry spurred the extremely fast growth of the region. Continued growth has caused agriculture to decline and the demand for residential development, service industries and transportation networks to increase giving rise to settlement patterns characteristic of urbanization.

The Lower South SF Bay watershed is the approximately 800 square mile Santa Clara Basin. This watershed has a current population of approximately 1.7 million[1] and is mostly urbanized, with some agricultural uses in the rural upper watershed areas. It is one of the fastest growing regions in California.

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[1] Santa Clara County year 2000 population from the Metropolitan Transportation Commission Website (http://www.mtc.dst.ca.us/datamart/forecast/ao/aotab45.htm) (Santa Clara, 2000)

Lower South SF Bay is a physically unique part of the San Francisco Bay estuary. It receives less freshwater because its tributaries are small in number and size. It is characterized by higher, more uniform salinities and is shallow with the exception of a deep central channel. Immediately adjacent to Lower South SF Bay lies a network of tidal mudflats, tidal sloughs, coastal salt marshes, diked salt marshes, brackish water marshes, salt ponds, and freshwater marshes, each of which has unique hydrologic properties.

3.2 Ambient Conditions

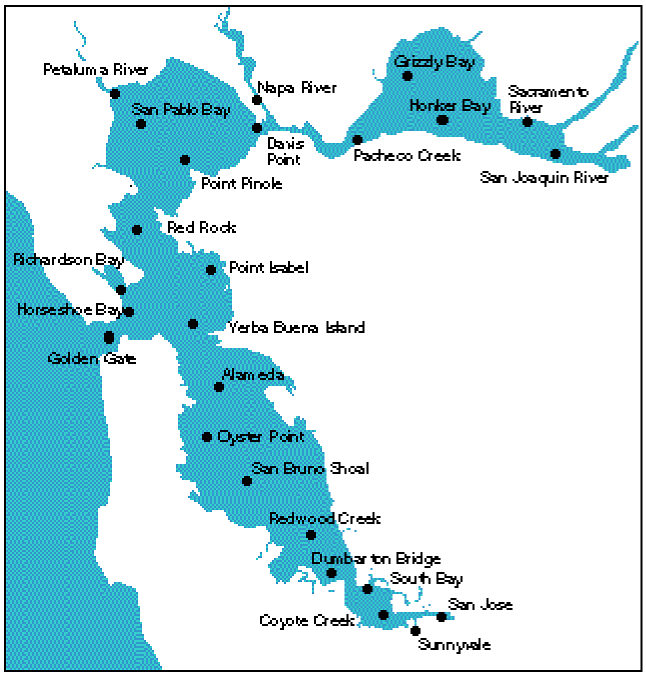

Figure 3-1 Map of San Francisco Bay showing monitoring locations for the Regional Monitoring Program for Trace Substances (RMP).

Average total and dissolved copper and nickel concentrations are higher in Lower South SF Bay than the rest of San Francisco Bay. Within Lower South SF Bay, they trend from higher in the south to lower in the north. The trends from the Lower South SF Bay to the Central Bay are shown in Figures 3-2 through 3-5. In each of these figures, the leftmost bar represents an average Lower South SF Bay total or dissolved metal concentration during the period 1997 to 2000 measured in micrograms per liter (µg/L). Moving to the right, each subsequent bar will represent either an average total or dissolved concentration from January 1996 through July 1999 at stations moving to the north in SF Bay. These stations are identified in Figure 3-1. On each plot, both the dry season (June through November) average and the wet season (December through May) average concentrations are shown.

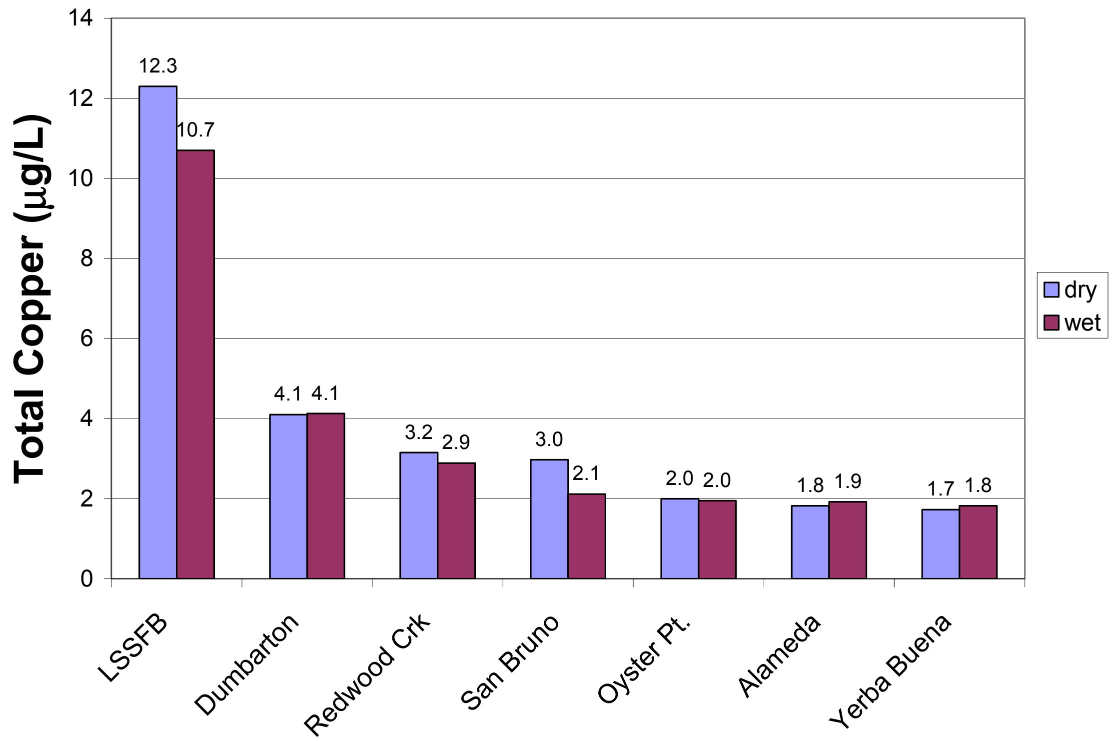

Figure 3-2 Average dry and wet season total copper concentrations in the reach from Lower South SF Bay to Central Bay.

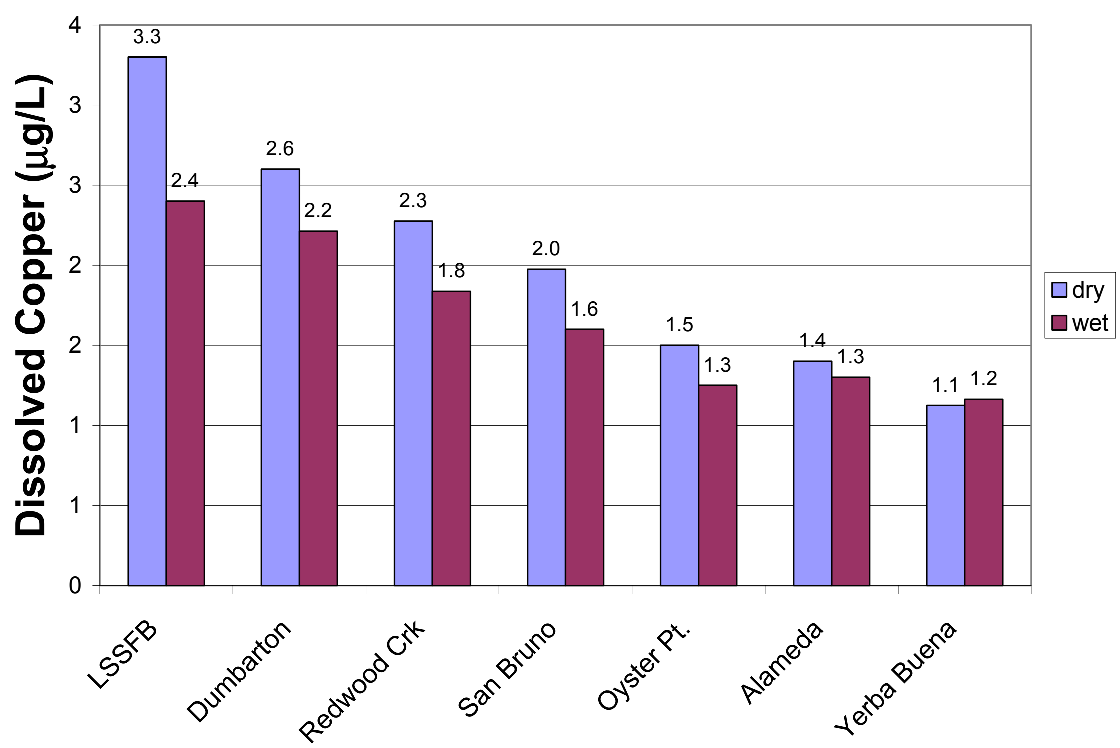

Figure 3-3 Average dry and wet season dissolved copper concentrations in the reach from Lower South SF Bay to Central Bay.

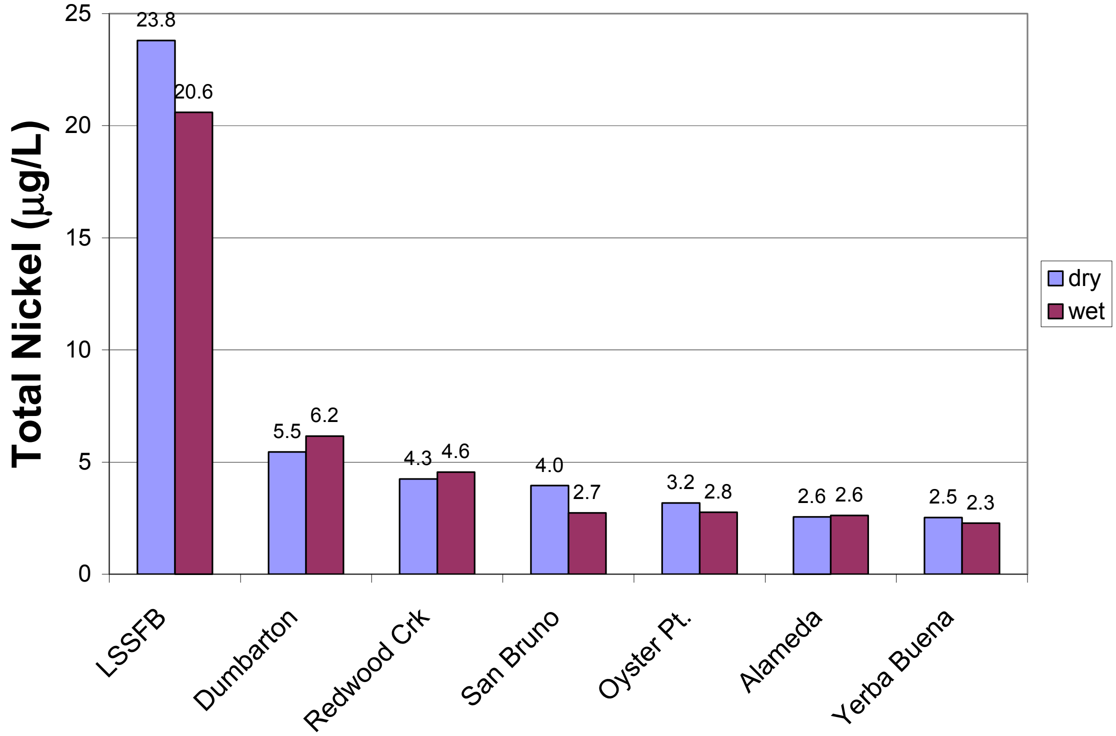

Figure 3-4 Average dry and wet season total nickel concentrations in the reach from Lower South SF Bay to Central Bay.

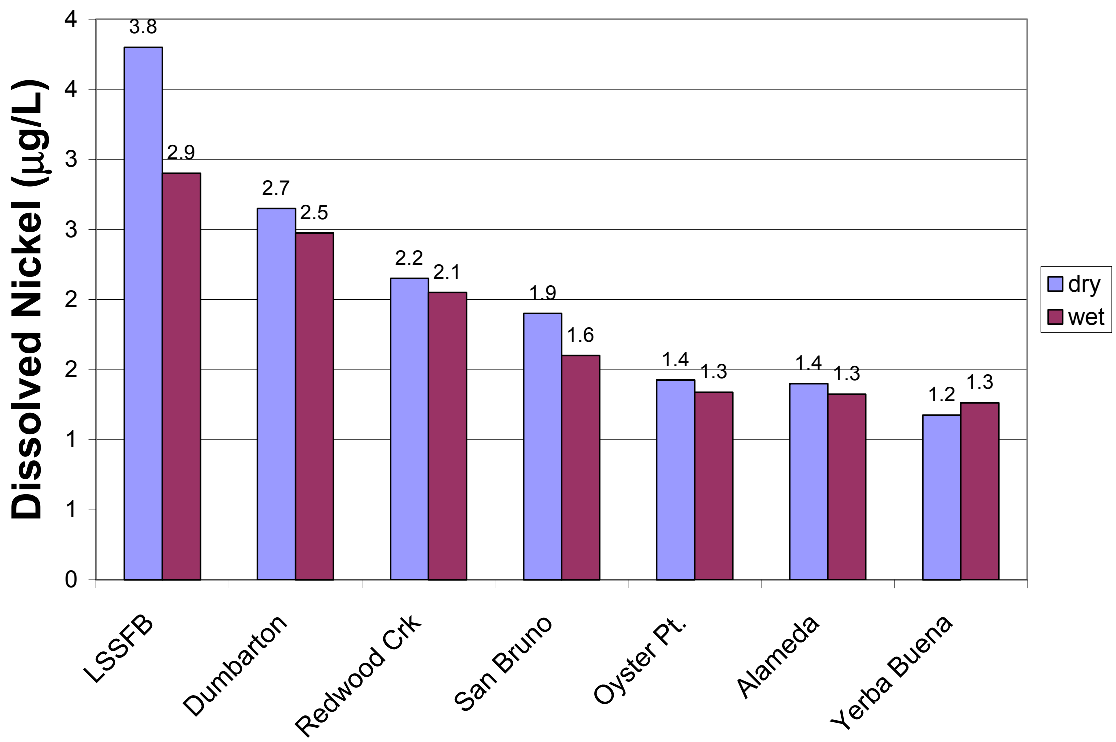

Figure 3-5 Average dry and wet season dissolved nickel concentrations in the reach from Lower South SF Bay to Central Bay.

Notice in Figure 3-3 that the average dry season dissolved copper concentration exceeds the current water quality objective of 3.1 µg/L. While the average dry and wet season dissolved nickel concentration (see Figure 3-5) is below the current water quality objective of 8.2 µg/L dissolved, there are occasional exceedances of the objective. The maximum observed concentrations of dissolved copper and nickel in Lower South SF Bay from 1997-2000 were 5.3 µg/L and 13.4 µg/L, respectively.

3.3 POTW Descriptions and Performance

The three following Santa Clara Valley advanced wastewater treatment plants discharge into Lower South SF Bay: San Jose/Santa Clara, Palo Alto, and Sunnyvale. The San Jose/Santa Clara Water Pollution Control Plant is the largest of the three, discharging an average dry weather (June-November) effluent flow of approximately 122 million gallons per day based on data from 1998 through 2000. The Sunnyvale plant discharged, on average, 14 million gallons per day over the same period. The Sunnyvale treatment facilities entail screening and grit removal, primary sedimentation, secondary treatment, nitrification, filtration, chlorination, and dechlorination. The treatment system is similar at San Jose, but secondary treatment and nitrification have recently been combined in one biological nutrient removal step. The Palo Alto Regional Water Control Plant treatment facilities consist of screening, primary treatment, fixed-film roughing filters for chemical and biochemical oxygen demand removal, activated sludge for nitrification, secondary clarification, dual media filtration, chlorination, and dechlorination. The Palo Alto treatment plant discharges an average dry weather flow of approximately 26 million gallons per day (1998-2000). Tables 3-1 and 3-2 show current performance statistics for total copper and total nickel, and Table 3-3 shows current and projected dry weather flow along with capacity for each plant.

Table 3-1 POTW performance statistics for total copper (based on 1998-2000 data)

POTW	Min (µg/L)	Mean (µg/L)	Max (µg/L)
San Jose	1.4	3.8	8.8
Sunnyvale	Non-detect (<1 µg/L)	3.0	8.1
Palo Alto	1.9	6.5	17

Table 3-2 POTW performance statistics for total nickel (based on 1998-2000 data)

POTW	Min (µg/L)	Mean (µg/L)	Max (µg/L)
San Jose	4.0	6.6	12
Sunnyvale	Non-detect (< 2 µg/L)	2.7	5.1
Palo Alto	0.8	4.4	7.7

Table 3-3 Current, projected and maximum POTW dry weather effluent volume (Current flow based on 1998-2000 dry weather data, June-November. Dry weather flows are listed because they are a better reflection of normal baseline operation and not influenced by increased flows during wet weather)

POTW	Current (MGD)[1]	Projected in 20 years (MGD)[2]	Capacity (MGD)
San Jose	122	120	167
Sunnyvale	14	16	29.5
Palo Alto	26	28	39

[1] Based on average of monthly flows for San Jose, weekly for Sunnyvale and Palo Alto
[2] Growth estimates based on the following: Sunnyvale 12.25% based on Association of Bay Area Government population growth projection for Santa Clara County between 2000 and 2020 (ABAG, 2001). San Jose Flow is limited in dry weather to 120 MGD or to flows that would not further impact rare and endangered species. Palo Alto 8% increase based on personal communication with Phil Bobel (2001) of the City of Palo Alto

3.4 Urban Runoff Program Description and Performance

The Santa Clara Valley Urban Runoff Pollution Prevention Program ("Program" or "SCVURPPP") is an association of 13 cities and towns in Santa Clara Valley, the County of Santa Clara, and the Santa Clara Valley Water District ("Co-permittees") that share a common permit to discharge storm water to Lower South SF Bay. The Program is organized, coordinated, and implemented through Memoranda of Agreement (MOA) dated 1990 and 1999. The Management Committee, consisting of one designated representative from each Co-permittee, is the official decision-making body for the Program.

The Regional Board issued the Program its first NPDES permit in 1990[2], and reissued the permit in 1995[3]and 2001[4].

3.4.1 The Program's Urban Runoff Management Plan

The Program and Co-permittees, consistent with the National Pollutant Discharge Elimination System (NPDES) permits, developed an *Urban Runoff Management Plan* ("URMP" (EOA, 2000b)) consisting of an area-wide plan and individual Co-permittee plans. The URMP describes goals, program elements, including monitoring and watershed management measures, and model performance standards including:

- Illicit Connection and Illegal Dumping Elimination Activities
- Industrial/Commercial Discharger Control Program
- Public Streets, Roads, and Highways Operation and Maintenance
- Storm Drain System Operation and Maintenance
- Water Utility Operation and Maintenance
- Planning Procedures
- Construction Inspection

[2] NPDES Permit No. CA0029718, Order No. 90-094.
[3] NPDES Permit No. CA0029718, Order No. 95-180 (as amended July 21, 1999).
[4] NPDES Permit No. CA0029718, Order No. 01-024.

In addition, the URMP presents a framework for the relationship between Program area-wide and Co-permittee specific Public Information/Participation ("PI/P") activities, that the Program and Co-permittees use to develop and conduct PI/P tasks.

The Program implements watershed management measures through its participation as a stakeholder in the Santa Clara Basin Watershed Management Initiative (SCBWMI). The Regional Board designated the Santa Clara Basin as one of the first watersheds in the San Francisco Bay Area targeted for water quality management utilizing a "watershed management approach," and formed the SCBWMI to facilitate stakeholder participation. The Program is working through the SCBWMI to: 1) identify and assess beneficial uses in the urbanized area of the watershed; and 2) identify and prioritize reasonable urban runoff control strategies. The Program participated in the SCBWMI Core Group and its subgroups, and has played a major role in funding and/or completing SCBWMI key work products.
Since 1990, the Program has conducted runoff and receiving water quality monitoring, performed special studies on sources of urban runoff pollution and control measures, and funded efforts to evaluate, protect and enhance beneficial uses of creeks in the Santa Clara Basin. The Program's Monitoring Plan implements the URMP goals and objectives, and consists of specific monitoring projects identified through the Program's continuous improvement process and participation in regional efforts (e.g., the Regional Monitoring Program and the Bay Area Stormwater Management Association Agencies (BASMAA) Regional Monitoring Strategy) and the SCBWMI.

3.4.2 Co-Permittee Urban Runoff Management Plans

In addition to the area-wide URMP, each Co-permittee has an URMP tailored to its local characteristics that contains appropriate strategies for local urban runoff controls, covering each of the Program elements (Industrial/Commercial Discharger Control, New Development and Construction, etc.). The Co-permittee URMPs include:

- performance standards (using the Program URMP's model performance standards as a template);
- work plans to implement performance standards;
- a description of the Co-permittee's legal authority;
- best management practices (BMPs); and
- standard operating procedures (SOPs) that detail conduct of control measures.

The Co-permittees also have responsibilities to conduct local PI/P programs, properly maintain corporation yards, conduct staff training, and participate in Program and SCBWMI activities.

By March 1 of each year, the Program submits to the Regional Board a draft work plan for implementation of the Program and Co-permittees URMPs for the coming fiscal year. The work plan includes clearly defined tasks, responsibilities, schedule, development of new or modified performance standards, an annual Monitoring Plan, and a definition of the Program role in watershed management efforts. The work plan builds on the baseline efforts conducted by the Program and Co-permittees through a "continuous improvement" process, in which the Program seeks new opportunities to control storm water pollution.

The Program and Co-permittees submit an annual report by September 1 of each year. The annual report serves as an important internal Program tool in the cycle of planning, implementation, evaluation, and continuous improvement. The annual report is the mechanism for documenting the status of planned activities, evaluating the effectiveness of those activities, and identifying potential improvements. An additional evaluation mechanism is holding local program performance review meetings with each of the Co-permittees. The annual report is a self-evaluation by the Program and Co-permittees, while the performance review meetings serve as external evaluations.

3.5 Loading Estimates and Uncertainties

Significant reductions to copper and nickel loading have been accomplished through the improved treatment technologies implemented at wastewater treatment facilities, industrial pre-treatment programs, and basin wide pollution prevention efforts. More than 20 years ago, POTWs contributed approximately 30,000 kilograms per year (kg/y) of total copper to Lower South SF Bay. Today, the POTWs contribute 1100 kg/y, or about four percent of the loadings 20 years ago (TetraTech, 2000b). Similarly for total nickel, over 20 years ago POTWs contributed approximately 12,000 kg/y to the Lower South SF Bay. Today, the POTWs contribute 1500 kg/y total nickel, or about 12 percent of the loadings of 20 years ago (TetraTech, 2000c). In the past 10 years alone, total copper and total nickel loads from POTWs have decreased by about 70% (TetraTech, 1998).

These decreased loadings are partially due to the advanced treatment systems in place at these three POTWs. Another major reason for the success is the strong commitment to source control and pretreatment programs. Some portion of the reduction prior to the 1990s is probably an artifact of improved laboratory techniques providing lower detection limits for metals analysis. In the NPDES permits issued to the South Bay municipal dischargers in 1993, the Regional Board required each discharger to implement an advanced pollution prevention program aimed at reducing, to the greatest degree feasible, the amounts of total copper and total nickel entering their facilities. The programs involved reducing total copper and total nickel from industrial, business and residential sources, as well as cooperating with purveyors of drinking water in activities aimed at reducing corrosion of copper water pipes (plumbing). All permitted industrial sources have been required to conduct audits of their facilities aimed at identifying cost-effective control measures for total copper and total nickel (see Appendix B).

These loading decreases have almost certainly played a part in helping to reduce ambient concentrations of dissolved copper and nickel in Lower South SF Bay. In fact, improvements can be seen in the last 10 years. From 1989-1991, the average dry season dissolved copper concentration in Lower South SF Bay was 4.3 µg/L, and the average wet season dissolved concentration was 3.5 µg/L. From 1998 to 2000, the average dry and wet season concentrations were 3.3 µg/L and 2.4 µg/L, respectively. Similarly for nickel, from 1989-1991, the average dry season dissolved nickel concentration in Lower South SF Bay was 6.4 µg/L, and the average wet season dissolved concentration was 5.8 µg/L. For the period from 1998 to 2000, the average dry and wet season concentrations were 3.8 µg/L and 2.9 µg/L, respectively.

The Conceptual Model Report (TetraTech, 1999) presents estimates of current total and dissolved copper and nickel loading to Lower South SF Bay. Loading includes both internal and external loading. Internal loading is that portion of metal delivered to the water column as a result of resuspension and diffusion from the sediments. External loading originates from sources on land (e.g. stormwater and effluent from wastewater treatment plants). The quantity of metals subject to internal loading consists of metals deposited in the sediments and metals in the geologic formations of the watershed. The metals deposited in the sediments consist of those deposited historically (higher than current levels) and those metals deposited from current ongoing discharges. The historical and current external loadings have elevated the total copper and possibly the total nickel concentrations of Lower South SF Bay sediments above what they would be in the absence of anthropogenic sources. The amount of copper in the sediments is estimated to be about 1.9 million kilograms and the amount of nickel in the sediments is estimated to be about 50 million kilograms (TetraTech, 1999).

The sediments can contribute to internal metal loading in the following two ways: diffusion of dissolved metal from the sediments to the water column (contributes both dissolved and total metals loading) and re-suspension of sediments (contributes total metals loading). Internal loading can also include 'internal cycling' in which changes occur in the exchange rates of dissolved copper and nickel between water and suspended sediments. When this phenomenon occurs, metals bound to mineral or soil surfaces are liberated when sediments are churning and mixing. Metals can also bind to suspended sediment and phytoplankton surfaces during spring blooms resulting in a loss of dissolved metals from the water column. The magnitudes of internal cycling fluxes are similar. They represent a net dissolved metals *source* during the dry season and a net dissolved metals *sink* during the wet season. Total copper and total nickel can also enter the bay from external pathways. The Conceptual Model Report provides estimates for three categories of external loading: POTWs, tributaries, and atmospheric deposition (TetraTech, 1999).

Tables 3-4 and 3-5 present estimates of dissolved and total copper and nickel loadings to Lower South SF Bay. Notice that for both copper and nickel, internal loading dominates the total metal loading, but external sources are larger than internal for dissolved metal loading. It is important to keep in mind that current external sources contribute metal to sediments that could later be released through internal loading mechanisms. Thus, external sources contribute both to current external loading and as well as to future internal loading.

Table 3-4 Summary of estimated copper loading to Lower South SF Bay (from Conceptual Model Report, TetraTech, 1999)

	Total Copper Loading			Dissolved Copper Loading		
	Dry season	Wet Season	Annual	Dry season	Wet Season	Annual
Copper Source	**Kg/dry season**	**Kg/wet season**	**Kg/year**	**Kg/dry season**	**Kg/wet season**	**Kg/year**
POTWs	500	700	1200	400	560	960
Tributaries	160	3600	3800	130	360	490
Atmospheric Deposition	60	60	120	0	0	0
Diffuse Flux from Sediments	110	110	220	110	110	220
Net Particulate Flux from Sediments	6300-7100	5200-5900	12000-13000	0	0	0
Internal Cycling (not a load)	0	0	0	540	-140	400

Table 3-5 Summary of estimated nickel loading to Lower South SF Bay (from Conceptual Model Report, TetraTech, 1999)

	Total Nickel Loading			Dissolved Nickel Loading		
	Dry season	Wet Season	Annual	Dry season	Wet Season	Annual
Nickel Source	**Kg/dry season**	**Kg/wet season**	**Kg/year**	**Kg/dry season**	**Kg/wet season**	**Kg/year**
POTWs	800	940	1700	640	750	1300
Tributaries	40	6000	6000	32	600	632
Atmospheric Deposition	15	15	30	0	0	0
Diffuse Flux from Sediments	360	360	720	360	360	720
Net Particulate Flux from Sediments	16000-18000	15000-16000	31000-34000	0	0	0
Internal Cycling (not a load)	0	0	0	700	-590	110

3.5.1 Uncertainties in the Loading Estimates

The loading estimates are not without uncertainty. Only the POTW loading estimates are highly certain because of the frequent measurement of effluent volumes and concentrations required for those facilities. The atmospheric deposition loading estimates come from a pilot study conducted by the San Francisco Estuary Institute (SFEI, 2001). The atmospheric deposition loading has a high degree of uncertainty, but it represents only a small fraction of total loading.

Wet season tributary runoff loads are the most important of the external loading, both in terms of magnitude and load reduction potential by watershed management or urban runoff control. The uncertainty of the load estimates could be reduced using more current or projected land use information, more recent and complete runoff concentration data, and more advanced models than were available when the estimates were made. Improving these load estimates is a priority work item in the baseline actions (described in Section 6 of this report).

Some uncertainty in the tributary loading estimates results from using the Guadalupe River station as a surrogate for all tributary input because the tributary watersheds vary in land use characteristics and amount of directly connected impervious surfaces. Further, the urban runoff contribution to tributary loading is difficult to assess from the limited quantitative data available and because the watershed draining to Lower South SF Bay is developing rapidly. Development and urbanization typically lead to more directly connected impervious surfaces, and this tends to increase urban runoff because water that would normally percolate into the ground is instead conveyed to surface waters by these impervious surfaces.

A potential copper-related concern is the increase in the amount of copper that is used to manufacture automobile brake pads. Two studies sponsored by the Santa Clara Valley Nonpoint Source Pollution Control Program (Woodward-Clyde, 1994, Woodward-Clyde and EOA, 1997) suggest that copper from brake pads contributes substantially to copper in urban runoff. The increased population and driving miles in the Lower South SF Bay watersheds could increase both urban runoff volumes and copper loadings.

The internal loading estimates are the most uncertain, and they are, unfortunately, large inputs that cannot be measured directly. These internal loads were estimated using a mass balance approach in which it was assumed that copper and nickel inputs to Lower South SF Bay were balanced by their export from the system at the Dumbarton Bridge. This assumption, combined with a flushing time based on the work of Monismith et al. (1999) and Gross (1997) of Stanford University, allowed an estimate of the internal loads to be made.

Since the sediments are a main repository of both historical and current loads, and since they continue to reintroduce copper and nickel to the water column through resuspension and sediment diffusion, it would be useful to improve our understanding of the copper and nickel movement into the sediments from existing external sources. This will be one of the goals of the baseline actions (see implementation plan discussion in Section 6).

4 Project Description

4.1 Project Necessity and Definition

There are two proposed regulatory provisions associated with the project: 1) establishing site-specific water quality objectives for dissolved copper and nickel in Lower South SF Bay, and 2) specification of metal translators to be used in the computation of water quality-based effluent limits for municipal wastewater dischargers. The other project elements are non-regulatory. The necessity of the regulatory provisions is as follows.

Despite significant reductions in wastewater loadings over the past decade, ambient concentrations of dissolved copper and nickel at stations in Lower South SF Bay monitored both through the San Francisco Estuary Regional Monitoring Program for Trace Substances (RMP) and the City of San Jose still approach or exceed the current, applicable water quality objectives (TetraTech, 2000a). These loading reductions are due to the success of source control and pollution prevention efforts by municipalities. However, further reductions in mass loading by wastewater dischargers may be difficult and costly, without providing corresponding water quality improvements. Other sources that are difficult to manage such as urban runoff, copper in brake pads, historical deposits of copper in bay sediments and natural sources of copper and nickel are among the dominant contributions to current ambient water concentrations. Furthermore and importantly, the impairment assessment for copper and nickel conducted for Lower South SF Bay (TetraTech, 2000a) demonstrated that the water quality objectives could be relaxed while still fully protecting beneficial uses. Consequently, site-specific water quality objectives for dissolved copper and nickel that protect beneficial uses are necessary to address the fact that current water quality objectives are not being met in Lower South SF Bay.

The project is a proposed Basin Plan amendment defined as follows:

1) Establish acute and chronic site-specific water quality objectives for dissolved concentrations of copper and nickel in Lower South SF Bay (i.e., south of the Dumbarton Bridge).
2) Amend Basin Plan (SFBWRQCB, 1995) language relating to regulatory strategies for Lower South SF Bay.
3) Set forth an implementation plan and a time schedule to support these SSOs, as well as to maintain existing ambient water quality. The implementation plan consists of:
    a) Required pollution prevention and source control actions on the part of Lower South SF Bay Municipal Urban Runoff Programs, POTWs, and other entities that are currently taking place and that will be maintained in the future through the permit process;
    b) An ambient water quality monitoring program to detect changes in ambient concentrations of dissolved copper and nickel in Lower South SF Bay along with a specification of dissolved concentration increases that will trigger additional aggressive control measures;

c) Already required aggressive actions to reduce controllable sources further that will be triggered by specific increases in ambient dissolved concentrations of copper and nickel during the dry season in Lower South SF Bay; and
d) Metal translators used to compute water quality-based effluent limits for Lower South SF Bay POTWs.

The other needed regulatory provision is the establishment of translators to calculate effluent limits from the proposed copper and nickel SSOs. Effluent limits for the POTWs must be calculated according to the procedure outlined in the SIP (SWRCB, 2000). This procedure calculates an Average Monthly Effluent Limit (AMEL) for the monthly average concentration of a regulated pollutant and a Maximum Daily Effluent Limit (MDEL). Both the AMEL and the MDEL are expressed as total metal concentration. For metals like copper and nickel, the calculation requires use of a ratio of total to dissolved metal called the metal translator. It is more efficient for the Regional Board to define, when appropriate, metal translators for a waterbody as a whole, rather than requiring special studies to determine translators on a discharger-by-discharger basis during NPDES permit reissuance.

4.2 Objectives of the Project

The objectives of the project are as follows:

1) Update the Basin Plan to incorporate the best available scientific information on appropriate acute and chronic water quality objectives for dissolved concentrations of copper and nickel in Lower South SF Bay that:
   a) Fully protect beneficial uses of Lower South SF Bay and prevent nuisance;
   b) Fully protect the public health or welfare, enhance water quality and serve the purposes of the Clean Water Act;
   c) Are calculated based on the best and most relevant set of data and are based on sound scientific rationale;
   d) Are no higher than necessary; and
   e) Are not so low as to compel POTWs to institute costly upgrades to their treatment facilities that do not provide corresponding water quality improvements, provided they maintain reasonably high levels of performance.

2) Establish SSOs that consider the following factors set forth in California Water Code Section 13241:

   a) Past, present and probable future beneficial uses of water;
   b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
   c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
   d) Economic considerations;
   e) The need for developing housing within the region; and
   f) The need to develop and use recycled water.

3) Provide details of an implementation plan for achieving water quality objectives that includes as set forth in California Water Code Section 13242:

   a) A description of the nature of actions that are necessary to achieve and maintain the objectives, including recommendations for appropriate action by an entity, public or private;
   b) A time schedule for actions to be taken; and
   c) A description of surveillance to be undertaken to determine compliance with objectives.

4) Comply with the antidegradation requirements of State Board Resolution No. 68-16 and federal antidegradation regulations (40 CRF 131.12).

4.3 Proposed Action/Project

The proposed project is the Regional Board adoption of the Basin Plan Amendment as provided in underline-strikeout format in Appendix A of this report.

5 TMDL Project Summary

5.1 Background

Before describing the details of the TMDL project, it is helpful to revisit the concept of a water quality standard since it is the backbone of both the TMDL project and water quality regulation. A water quality standard defines the water quality goals of a water body by designating its uses, by setting the numeric or narrative criteria necessary to protect these uses, and discourages water quality degradation through antidegradation provisions. States adopt water quality standards to protect public health and welfare, enhance water quality, and serve the purposes of the federal Clean Water Act. Water quality criteria designed to protect aquatic organisms are generally of two types – the Criteria Continuous Concentration (CCC) and the Criteria Maximum Concentration (CMC).

The CCC are the USEPA national water quality criteria recommendations for the highest instream concentrations of a pollutant to which organisms can be exposed *indefinitely* without causing an unacceptable effect and thus protecting against chronic toxicity. The CMC are the USEPA national water quality criteria recommendations for the highest instream concentrations of a pollutant to which organisms can be exposed for a *brief period of time* without causing an unacceptable effect, thus protecting against acute toxicity[5].

When the California Toxics Rule (CTR, 40 CFR Part 131) was promulgated in May 2000, the criteria set forth therein became the default water quality objectives for Lower South SF Bay. Thus, the water quality objectives for copper applicable in Lower South SF Bay are a CCC of 3.1 µg/L dissolved copper and a CMC of 4.8 µg/L dissolved copper. The water quality objectives for nickel applicable in Lower South SF Bay are a CCC of 8.2 µg/L dissolved nickel and a CMC

[5] EPA 199l. Technical Support Document for Water Quality-based Toxics Control. Office of Water, Washington, DC. EPA 505/2-90-001. NTIS #PB 91-127415. (Source #2.)

of 74 µg/L dissolved nickel. The four-day average ambient concentration in Lower South SF Bay must not exceed the CCC more than once every three years. The instantaneous (practically, a one-hour average) concentration must not exceed the CMC more than once every three years.

Data collected from 1997 to 2000 indicate that the current average dissolved copper concentration in the Lower South SF Bay during the dry season is 3.3 µg/L and the wet season is 2.4 µg/L. There were over 200 samples exceeding the value of 3.1 µg/L observed from 1997-2000. Two of these samples exceeded the CMC of 4.8 µg/L. The maximum observed value was 5.3 µg/L during this period. Thus, despite the previously mentioned substantial reductions over the last ten years in POTW copper loadings and the current lower ambient concentrations, the Lower South SF Bay still frequently exceeds the May 2000 CTR water quality objectives for copper, especially during the dry season.

Data collected from 1997 to 2000 indicate that the current average dissolved nickel concentration in the Lower South SF Bay during the dry season is 3.8 µg/L and is 2.9 µg/L during the wet season. The maximum observed value during this period was 13.4 µg/L. There were six samples exceeding the current CCC of 8.2 µg/L. None of the samples exceeded the CMC value of 74 µg/L. Thus, despite the substantial reductions of POTW nickel loadings and lower ambient concentrations, the Lower South SF Bay still occasionally fails to meet the May 2000 CTR water quality objectives for nickel.

5.2 Overview of the TMDL Project for Copper and Nickel in Lower South SF Bay

In 1996, the State of California included the Lower South SF Bay on the 303(d) impaired water body list as a high priority impaired water body. In 1998, the RWQCB and USEPA updated the list and specifically identified copper, nickel, mercury and selenium as the metal pollutants of concern. This listing triggered a Clean Water Act mandate for the State of California, specifically the RWQCB, to establish Total Maximum Daily Loads (TMDLs) for the pollutants of concern. To address NPDES permit issues for its wastewater treatment plant, the City of San Jose and tributary agencies took the lead in providing funding for the development of the copper and nickel TMDLs for Lower South SF Bay, and other Lower South SF Bay communities participated in related Santa Clara Basin Watershed Management (SCBWMI) activities.

In 1998, the Copper and Nickel TMDL Work Group (TWG) was formed by the SCBWMI to provide guidance for the development of the TMDLs for copper and nickel in Lower South SF Bay. A broad group of stakeholders is represented on the TWG, including several environmental groups, POTWs, public agencies responsible for the urban runoff program, state and federal regulators, industry and business representatives, and national organizations such as the Copper Development Association. A TMDL consultant team was selected and retained by the City of San Jose.

One of the first TWG actions was to recognize the TMDL effort as a decision-making, rather than information gathering, process. The objectives were to:

1. Conduct an Impairment Assessment to determine whether ambient copper and nickel concentrations were negatively impacting the Lower South SF Bay beneficial uses;

2. Develop a range of scientifically defensible copper and nickel water quality objectives/standards; and
3. Develop a conceptual copper and nickel cycling model to evaluate attainment of the range of objectives/standards.

The results of these objectives would be used to reevaluate both the impairment status of Lower South SF Bay and the need for conducting a complete TMDL with load allocations. The final steps involved development of an implementation plan and routine monitoring plan to re-assess the results of the original effort.

The TWG oversaw the preparation and review of several technical reports to support the conclusions and recommendations on the effects of ambient concentrations of copper and nickel on the beneficial uses of Lower South SF Bay.

5.2.1 Source Characterization Report

The TMDL effort led to the quantification of major copper and nickel sources entering the Lower South SF Bay (wastewater discharges, tributary loads, atmospheric deposition, and sediment exchange). Loading estimates and the seasonal variation of these loadings were identified. Source characterization also identified uncertainties in loading estimates to guide additional efforts to improve the estimates.

5.2.2 Impairment Assessment Report

This report presented new information and re-evaluated the determination that the Lower South SF Bay beneficial uses were impaired by ambient copper and nickel concentrations. The specific goals of the assessment were to:

- Compile and evaluate data on ambient concentrations and toxicity of copper and nickel in the Lower South SF Bay;
- Identify, evaluate and select indicators of beneficial use impairment including toxicity (acute/chronic), biological (biota composition, health, abundance, and physical habitat), chemical (ambient concentrations), and physical;
- Develop endpoints for the selected indicators for assessing impairment and compare these to ambient concentrations in Lower South SF Bay. This will provide policy makers, regulators, and other stakeholders with current laboratory and ambient data to compare with known threshold impact levels on selected indicators;
- Assess the level of certainty with which it can be shown whether or not ambient copper and nickel concentrations impair beneficial uses; and
- Recommend numeric values for site-specific dissolved copper and nickel objectives in Lower South SF Bay.

The assessment relied on a “weight of technical evidence” approach. All evidence was reviewed and incorporated in proportion to its relevance, technical certainty, and statistical robustness to evaluate impacts on designated beneficial uses.

5.2.2.1 Impairment Assessment Report Results

The impairment assessment results indicate that beneficial use impairment in Lower South SF Bay due to ambient copper and nickel concentrations is unlikely. The several lines of evidence supporting this finding are discussed fully in the Impairment Assessment Report (TetraTech, 2000a) and summarized here.

For copper, the first line of evidence is a conservative screening analysis that assumes that if the aquatic species most sensitive to copper is not impacted by ambient dissolved copper concentrations in Lower South SF Bay, the other aquatic species less sensitive to copper will not be impacted either. Further, all beneficial uses will be fully protected if beneficial uses relating to aquatic life (uses most sensitive to copper and nickel) are protected. The water column dissolved copper concentrations do not exceed chronic toxicity values for *Mytilus edulis* (blue mussels), the most sensitive species in the national database tested for copper toxicity. The toxicity of copper in Lower South SF Bay is reduced by the presence of dissolved organic compounds that bind the copper making it less bioavailable and the presence of metals like manganese or iron that compete with copper for receptor sites on or in the organism (TetraTech, 2000a).

The second line of evidence is that Lower South SF Bay ambient waters are routinely monitored for chronic water column toxicity to aquatic organisms. Chronic water column toxicity in the Lower South SF Bay has been rarely observed. Copper has never been attributed as the cause of any observed toxicity.

The RMP and the United States Geological Survey (USGS) (Hornberger et al., 1998; Luoma et al., 1998a and 1998b) have routinely measured Lower South SF Bay bivalve tissue copper concentrations. USGS correlated historical elevated sediment and bivalve tissue copper levels with reduced bivalve reproductive capacity. The USGS study also demonstrated that the Lower South SF Bay region, once highly impacted by copper, is no longer so impacted relative to bivalve reproduction.

Impairment by nickel is unlikely based on the following evidence. A combination of the indicator species and recalculation procedures discussed in the next section was used to develop site-specific modifications to the national water quality criterion for nickel. The 1989-1999 water quality database showed that the lower end of the resultant range (see below) of objectives was exceeded once (out of the 794 samples collected). No measurements exceeded the upper limit of the range. Site-specific case studies for San Francisco Bay and Lower South SF Bay demonstrated that nickel toxicity is less in ambient site-water than predicted by the national water quality criteria, possibly because of the organic binding of nickel and the presence of metals like manganese and iron that compete with nickel for receptor sites on or in the organism (TetraTech, 2000a).

5.2.2.2 Scientifically Defensible Range of Site Specific Objectives (SSOs)

Because it was determined that ambient concentrations of dissolved copper and nickel were not likely impairing Lower South SF Bay beneficial uses, a full TMDL with load allocations and margin of safety is not necessary. Rather, the TMDL project focused on developing a scientifically-justified numeric range of SSOs for these metals that would protect beneficial uses. Key components of the analysis were: laboratory-measured toxicity data and laboratory-measured water effects ratios (WERs). It was found that there was sufficient scientific knowledge to establish SSOs for dissolved copper and nickel (TetraTech, 2000a).

Site-specific objectives may be developed where conditions warrant less stringent effluent limits than those based on promulgated water quality standards or objectives, without compromising the beneficial uses. The SIP states in Section 5.2 that site-specific objectives may be adopted by a Regional Board whenever it determines in the exercise of its professional judgment that it is appropriate to do so. Where an existing objective cannot be met through reasonable treatment, source control, and pollution prevention measures, site-specific objectives may be appropriate. The SIP requirements are met for the Lower South SF Bay. The current copper and nickel criteria set forth in the CTR are not currently being met consistently in Lower South SF Bay despite discharger's reasonable treatment, source control, and pollution prevention measures.

As set forth above, Clean Water Act Section 303(c), California Water Code Section 13240 et seq., 40 CFR Section 131.11(b)(ii) and the SIP provide the regulatory authority for the Regional Board to develop and adopt site-specific criteria for water quality standards. Several USEPA-approved procedures (USEPA, 1994) can be used to modify national criteria to more accurately reflect ambient conditions and metals bioavailability. The two procedures pertinent to this project are:

- <u>Recalculation Procedure</u> – The recalculation procedure allows modification of the national criterion by correcting, adding or removing data from the national toxicity database. Toxicity databases are collections of laboratory-measured toxicity values for various species and form the basis of water quality criteria promulgated by USEPA. The goal of the Recalculation Procedure is to create an appropriate dataset for deriving a site-specific criterion by modifying the national dataset as follows:
  a. Correction of data that are in the national database;
  b. Addition of data to the national database; and/or
  c. Deletion of data from the national database (e.g. elimination of data for non-resident species).

- <u>Indicator Species Procedure</u> – This procedure allows modifications of the national criterion by using a site-specific multiplier, called a water effects ratio, to account for ambient water quality characteristics affecting the bioavailability of metals like copper and nickel. A WER is the ratio of toxicity of a given pollutant in site water to toxicity in laboratory water, based on toxicity tests administered to an appropriately sensitive species. A WER accounts for the actual site-specific toxicity of a metal due to the effects of other constituents in the site water. If the value of the WER exceeds 1.0, the site water reduces the toxic effects of the pollutant being tested. For example, a water with a WER = 2 suggests that the ambient water concentration could be double its laboratory water value while affording the same protection for aquatic organisms. Adjustments to the acute and chronic USEPA criteria are made by multiplying the USEPA water quality criteria values by the WER.

These two procedures can be used to calculate both acute and chronic criteria. Acute toxicity refers to adverse effects that are the result of a short period of exposure to a toxic substance. The acute criterion, also known as the CMC, is an estimate of the highest concentration of a material to which an aquatic organism can be exposed briefly without resulting in an unacceptable effect. Chronic toxicity refers to adverse effects produced from long-term exposure. The chronic criterion, also known as the CCC, is an estimate of the highest concentration of a material to which an aquatic organism can be exposed continuously without resulting in an unacceptable effect. Chronic toxicity is more difficult to measure than acute, because chronic toxicity, by definition, takes a long time to observe. As a result, chronic and acute tests are normally performed on just a few species to determine a ratio between the two values, termed an acute-to-chronic ratio (ACR). This ACR is then used to convert known acute values to estimated chronic values for a given pollutant. Chronic toxicity is produced by lower concentrations than acute toxicity and tends to drive impairment concerns and effluent limitations. Because of this, the copper and nickel assessment efforts in the Lower South SF Bay focused primarily on chronic toxicity.

Development of the Site-Specific Objective Range for Copper

The development of site-specific objectives for copper in the Lower South SF Bay involved combining the recalculation procedure and the indicator species procedure. Details of the calculations are provided in the Impairment Assessment Report (TetraTech 2000). A summary is provided below.

The first step uses toxicity data to determine a final acute value (FAV), an estimate of the concentration of a pollutant that is protective of 95% of the genera represented in the data set. The use of the recalculation procedure results in new FAVs. The FAV or acute value is the basis for both the chronic and the acute criterion. The FAV is divided by two and multiplied by the WER to calculate an acute criterion. Division by two is a protective measure intended to result in a concentration that will not adversely affect organisms severely. The acute value is divided by an ACR and then multiplied by the WER to produce a chronic criterion.

These calculations can be summarized as follows (from USEPA, 1994, Appendix L):

Acute Criterion: (acute value / 2) x WER = Acute SSO
Chronic Criterion: (acute value / ACR) x WER = Chronic SSO

The development of FAVs (or acute toxicity values) for copper considered the extent to which Lower South SF Bay resident species and newly collected laboratory-measured toxicity data should be incorporated into the national toxicity database to calculate water quality criteria. Four databases were considered for use in the development of acute toxicity values for the Lower South SF Bay:

- National Database: This database contained all species included in the USEPA's National Water Quality Criteria Dataset.

- Updated National Database: This database incorporates new data collected for sea urchins ((*Strongylocentrotus purpuratus*) and blue mussels (*Mytilus edulis)* as part of the City of San Jose's study into the national saltwater copper database.
- Resident and Surrogate: This is a modification of the national database that excludes nonresidents, but it does include commonly used surrogates for resident species for which no toxicity information exists.
- Resident: This is a modification of the national database that includes only those species that are resident in San Francisco Bay.

To calculate chronic criteria (CCC) from acute values, two different ACRs were considered for copper, the currently accepted USEPA ACR value of 3.127 and a value of 2.388, the saltwater ACR value currently under review by USEPA.

Next, the Indicator Species procedure is used to convert the recalculated "national" values to site-specific values using a WER. WERs for the copper SSO were developed as part of the toxicity work performed by the City of San Jose for their 1998 study entitled *Development of a Site-Specific Water Quality Criterion for Copper in South San Francisco Bay* (City of San Jose, 1998a).

Two WERs were considered: a two-station-based WER and a three-station-based WER. The two-station WER was calculated using toxicity data from the two study sites near the Dumbarton Bridge at the Northern edge of Lower South SF Bay. The three-station WER uses all the WER data collected in the City of San Jose study, including both Dumbarton stations in the North and the Coyote Creek station in the Southern portion of Lower South SF Bay. Both WERs have their merits. The three-station WER uses all WER data collected, but may be under protective of the northern reach of the Lower South SF Bay and overprotective of the southern portion. The two-station WER better characterizes the northern boundary of Lower South SF Bay where dissolved concentrations and copper binding (by dissolved organic compounds thus reducing bioavailability) are lower, however, it may yield SSOs that are overprotective of the southern portion of the Lower South SF Bay.

The range of 5-12 µg/L dissolved copper results from employing different combinations of toxicity databases, acute-to-chronic ratios, and WERs. The site-specific objectives in this range are scientifically defensible and protect beneficial uses within Lower South SF Bay because each component of the calculation is scientifically defensible. The SSOs in Table 5-1 are based on the best available data for the Lower South SF Bay and our current understanding of the Lower South SF Bay.

Table 5-1 Details Showing Calculation of Copper SSO Range

Toxicity Database	FAV or acute value[i]	WER	Acute SSO[ii]	ACR	Chronic SSO[iii]
Resident Species	5.3	2.77	7.3	3.127	4.7
		2.77	7.3	2.388	6.1
		3.00	8.0	3.127	5.3
		3.00	8.0	2.388	6.7
Updated National	7.89	2.77	10.8	3.127	6.9
		2.77	10.8	2.388	7.0
		3.00	11.8	3.127	7.6
		3.00	11.8	2.388	9.9
National Database	8.2	2.77	11.4	3.127	7.3
		2.77	11.4	2.388	9.5
		3.00	12.3	3.127	8.2
		3.00	12.3	2.388	10.3
Resident/Surrogate	10.0	2.77	13.9	3.127	8.9
		2.77	13.9	2.388	11.6
		3.00	15.0	3.127	10.0
		3.00	15.0	2.388	12.6

[i] The acute value shown in this column is a FAV for the Updated National Database. For other cases, the acute value was generated through a statistical model called AERAP. See the Impairment Assessment Report (TetraTech, 2000a) for details.
[ii] Acute SSO = (acute value/2) x WER (units are µg/L)
[iii] Chronic SSO = (acute value / ACR) x WER (units are µg/L)

The Impairment Assessment Report recommended a scientifically justifiable range of site-specific chronic objectives for dissolved copper (5-12 µg/L). Because the chronic objectives are the more restrictive objectives (i.e. the chronic values are occasionally exceeded, but the acute values are not), the acute values would be chosen as those corresponding to whatever chronic values were selected. In selecting from recommended ranges of chronic objectives, consideration was first given to the lowest number in the range. If no compelling scientific justification could be provided for considering a higher value, the lower end of the range would be selected.

For copper, there are compelling scientific reasons for not choosing the lower end (5 µg/L) of the recommended range. The proposed value is 6.9 µg/L dissolved copper. The corresponding proposed acute value is 10.8 µg/L. These site-specific chronic and acute values were determined to result from the most appropriate and technically justifiable combination of the three contributing factors. The rationale for this decision is provided in the following paragraphs.

First, both the proposed acute (10.8 µg/L) and chronic (6.9 µg/L) copper site-specific objective values rely on the USEPA's national toxicity dataset augmented with toxicity data collected by the City of San Jose. Using this dataset is considered the best use of all relevant available data. The lower end of the site-specific objective range for copper resulted from the use of toxicity data from a resident species database. Use of the resident species database, which only includes those species in the national database that are resident in San Francisco Bay, is not recommended because it does not account for several ecological niches or taxonomic groups that are included in the larger national database. Use of a resident/surrogate database is not recommended because it does not take full advantage of information in the national because non-resident species have been removed. More importantly, the resident/surrogate database does not make use of the site-specific data collected by the City of San Jose. However, it is necessary to review the choice of toxicity database on a case-by-case basis since the best choice will depend on the toxicity information available for an individual pollutant.

Second, the acute-to-chronic ratio (ACR) used in the calculation of the proposed 6.9 μg/L dissolved copper chronic objective is the most technically defensible choice for this factor since it is the current USEPA copper ACR.

Third, the WER of 2.77 selected to convert the recalculated national values to site-specific objectives was the most technically defensible choice. Two WERs were considered for use in development of copper SSOs for Lower South SF Bay: a two-station WER and a three-station based WER. The two-station WER was calculated using data from the two study sites near the Dumbarton Bridge at the Northern edge of Lower South SF Bay. The three-station WER uses all the WER data collected for the study, including both Dumbarton stations in the North and the Coyote Creek station in the Southern portion of Lower South SF Bay. The two-station WER (2.77) was selected because data from the two Dumbarton stations were the most temporally consistent and because this WER is most appropriate for characterizing and protecting the northern boundary of this bay segment where the copper binding capacity tends to be lower than in the southern portion.

In summary, the most defensible options were chosen for the toxicity database, WER value, and ACR for copper, and these options yielded the recommended acute (10.8 μg/L) and chronic (6.9 μg/L) site-specific objective values for dissolved copper.

Development of the Site-Specific Objective Range for Nickel

The nickel SSO was developed using the recalculation procedure only since it was deemed inappropriate to use the statistical approach, AERAP, used for copper (TetraTech, 2000a). A new acute value and a new acute-to-chronic ratio were developed by adding laboratory toxicity data for additional species to the national database.

The 1998 study *Acute and Chronic Nickel Toxicity: Development of a Site-Specific Acute-to-Chronic Ratio for South San Francisco Bay* (San Jose, 1998b) was the basis for the site-specific range identified in the Impairment Assessment Report (TetraTech, 2000a). This study developed additional acute and chronic data for nickel toxicity, using West Coast marine organisms, to assist in evaluating a site-specific nickel criterion for Lower South SF Bay.

The Impairment Assessment Report (TetraTech, 2000a) presents the methodology for calculating a range of site-specific objectives for dissolved nickel for Lower South SF Bay. These calculations are summarized below. The Impairment Assessment Report determined that a chronic site-specific objective for dissolved nickel in the range of 11.9 to 24 μg/L dissolved nickel was scientifically defensible and fully protected beneficial uses in Lower South SF Bay.

The existing water quality criterion for nickel in saltwater or brackish water is based, in part, on toxicological data from two freshwater and one marine species. The 1998 City of San Jose study (San Jose, 1998b) added additional species to the national dataset. The range of nickel SSOs identified in the Impairment Assessment Report was developed using various combinations of toxicity datasets and acute-to-chronic ratios. Specifically, two toxicity datasets, and two acute-to-chronic ratios were used as follows: an updated national dataset including the resident and west coast species data generated by the City of San Jose; a Lower South SF Bay resident species dataset; a combined fresh water and marine ACR; and marine ACR. A range of scientifically defensible and protective nickel SSOs between 11.9 and 24 µg/L dissolved was obtained. Note that this range is a recalculation of the national criterion applicable to the entire San Francisco Bay rather than just Lower South SF Bay because no information specific to Lower South SF Bay was used in the calculation. The SSOs in Table 5-2 are based on the best available data for the Lower South SF Bay and our current understanding of the Lower South SF Bay. The Impairment Assessment Report recommends a chronic SSO range from 11.9-21 µg/L dissolved nickel. This is the range that would result if the Resident Species database is considered rather than the Updated National database.

Table 5-2 Details Showing Calculation of Nickel SSO range (SSO units are µg/L)

Toxicity Database	FAV	Acute SSO[i]	ACR	Chronic SSO[ii]
Updated National	145.5	72.75	10.5	13.9
			5.95	24.5
Resident Species	124.8	62.40	10.5	11.9
			5.95	21.0

[i] Acute SSO = FAV/2

[ii] Chronic SSO = FAV/ACR

For nickel, the lower end of the range identified in the Impairment Assessment Report results from the most defensible set of scientific information. Hence, there are no compelling scientific reasons for choosing a site-specific dissolved objective higher than the lower end (11.9 µg/L) of the recommended range. The corresponding proposed acute value is 62.4 µg/L (like copper, the chronic objectives are more restrictive, and thus the acute values is chosen based on the corresponding chronic value). These site-specific chronic and acute values were determined to result from the most appropriate and technically justifiable combination of the two contributing factors described below.

First, both the proposed acute (62.4 µg/L) and chronic (11.9 µg/L) nickel site-specific objective values rely on the resident species toxicity dataset, which is the more appropriate and extensive nickel toxicity dataset for Lower South SF Bay compared to the national data set. Note that use of the updated National dataset was preferred for copper because there were additional site-specific copper toxicity data collected by the City of San Jose to augment the National database. In the absence of such additional site-specific toxicity data for nickel, the resident species toxicity dataset is the best choice to represent the collection of aquatic species actually found in Lower South SF Bay. Second, the acute-to-chronic ratio (ACR) that results in the calculation of the proposed 11.9 µg/L dissolved nickel chronic objective is the most technically defensible choice for this factor. The chosen ACR (10.5) was derived from a combination of freshwater and marine species that was deemed most appropriate for the estuarine environment of Lower South SF Bay (TetraTech, 2000a).

5.2.2.3 Uncertainties Identified Through the Impairment Assessment

The weight of available evidence supports both the assessment findings that the Lower South SF Bay is not impaired for both copper and nickel and that SSOs are scientifically-justified and appropriate. Hence, the RWQCB is confident in moving forward with the proposed project for SSOs and associated IP described in Section 6 of this report. However, as is the case for most questions concerning complex environmental systems, there are some uncertainties. The four areas of remaining uncertainty are the copper toxicity to phytoplankton, copper and nickel cycling, copper sediment toxicity, and loading estimates. These uncertainties motivate the pollution prevention actions and other actions of the Implementation Plan (“IP”). Further, the IP contains actions that are expressly directed at reducing these areas of remaining uncertainty.

5.2.2.3.1 Uncertainty in Phytoplankton Toxicity

Because phytoplankton are very sensitive to copper, they are an important consideration in the impairment assessment. However, little information is available on the copper toxicity to phytoplankton under the specific water quality and metal speciation conditions in Lower South SF Bay. Some phytoplankton species are very sensitive to low free ionic copper concentrations. The data used to establish the site-specific objective does not include these species. Even though ambient levels of copper are high enough to be toxic to certain phytoplankton species according to some laboratory studies, some of these sensitive species have been recently observed in Lower South SF Bay. It has not been determined whether populations are reduced or stressed by ambient dissolved copper levels. The phytoplankton toxicity data appear inconsistent, with some studies suggesting that ambient dissolved copper concentrations in Lower South SF Bay are not toxic to sensitive phytoplankton species. Other studies indicate that existing ambient concentrations of dissolved copper are in the range that could be toxic to sensitive phytoplankton.

This uncertainty is not unique to Lower South SF Bay. It needs to be resolved at the national level. There are currently studies underway funded by the City of San Jose that should help resolve this issue. The RWQCB believes that resolution of the phytoplankton toxicity uncertainty is a high priority, but it should not delay establishment of appropriate site-specific objectives protective of beneficial uses.

5.2.2.3.2 Uncertainty in Biogeochemical Processes Influencing Speciation

Trace metals, such as copper and nickel, can exist in a number of chemical forms (speciation) that differ in their toxicity to aquatic organisms. Metals can be strongly or weakly bound (complexed) to a variety of inorganic and organic materials. Complexed metals are less available for uptake by aquatic organisms and are less likely to be toxic. Only limited copper and nickel speciation data are available for Lower South SF Bay. The components of the complexing capacity are fairly well known, but the seasonal and annual variability in the individual complexing agents are not. Copper toxicity integrates the bioavailability of the metal. The baseline actions include a study to characterize the seasonal and spatial variability in copper speciation.

5.2.2.3.3 Uncertainty in Copper Sediment Toxicity

No definitive methods exist for determining whether observed sediment toxicity is caused by copper. Sediments are complex and even though many of their chemical constituents are known, interactions between these constituents and copper are unclear. Copper concentrations are elevated in Lower South SF Bay sediments relative to background concentrations (TetraTech, 1999). Even so, it is extremely difficult to demonstrate that copper is the cause for any observed sediment toxicity. The Lower South SF Bay sediments are routinely monitored for toxicity to aquatic organisms (both benthic and planktonic). The most comprehensive source of sediment monitoring data comes from the San Francisco Regional Monitoring Program (RMP). The RMP has monitored Lower South SF Bay sediments for toxicity twice annually since 1993. They have determined that the Lower South SF Bay sediments are consistently toxic to benthic amphipods, with their "South Bay" site exhibiting toxicity in 63% of the toxicity tests performed. Other studies performed by Larry Walker Associates (1991a,b) indicated that Lower South SF Bay sediments were not toxic to aquatic organisms. It should be noted that sediment toxicity is a poorly understood phenomenon that is observed throughout San Francisco Bay and is not unique to Lower South SF Bay (SFEI, 2000).

5.2.3 Copper and Nickel Conceptual Model

An essential part of the TMDL project was development of a conceptual model for copper and nickel behavior in the Lower South SF Bay. The Conceptual Model Report, using graphics and text, presented the information that had been developed on loadings, sediment transport, copper and nickel cycling, the relative importance of various forcing functions, and the ecological effects of these metals. The Conceptual Model Report provides an excellent summary of the existing knowledge on the behavior of copper and nickel in the South Bay as well as the factors that affect the cycling and potential toxicity of copper and nickel in the ecosystem.

5.2.4 Copper and Nickel Action Plans

A final, but essential, step in the TMDL project was the development of Copper and Nickel Action Plans. These are part of a non-degradation strategy and are already and will continue to be implemented in POTW and Urban Runoff Program NPDES permits to ensure that existing water quality is maintained, beneficial uses are fully protected, and exceedances of the site-specific water quality objectives for copper and nickel do not occur. These Action Plans: 1) identify the current control measures/actions implemented immediately to minimize copper releases to the Lower South SF Bay, 2) identify "triggers" that would initiate additional measures/actions, and set forth a proactive framework for addressing future increases of copper and nickel concentrations in Lower South SF Bay. Since these Action Plans are the centerpiece of the strategy for maintaining water quality in Lower South SF Bay in the future, they are discussed at length later in Section 6 of this report.

5.2.5 Lessons Learned from the TMDL Project

The TMDL process in Lower South SF Bay has yielded valuable information. New scientifically-based, site-specific water quality objectives have been developed that are protective of the beneficial uses of the water body and that are supported by the regulatory agencies, environmental advocacy groups, industry, and the municipalities. Through the comprehensive review of available and pertinent evidence in the Impairment Assessment, we learned that a full TMDL is not necessary to protect beneficial uses and that the proposed copper and nickel SSOs and supporting IP are justified. The success of the TMDL process can be attributed to four key elements:

1. **Regulatory Framework.** The TMDL is as a process rather than a prescriptive requirement. The TMDL process benefited from the newly emerging regulatory framework that focuses on stakeholder involvement and watershed management principles.

2. **Stakeholder Involvement.** While scientific and technical information serve as a foundation for regulatory decisions, many decisions that address uncertainty are policy based. Developing communication and consensus-building opportunities through the use of broad-based stakeholder involvement is effective.

3. **Technical Approach and Scientific Credibility.** The copper and nickel studies were the most comprehensive, chemical-specific, environmental assessments ever conducted in Lower South SF Bay. A key ingredient of a successful process was the use of outside experts to review the technical materials. Technical Review Committees (TRCs) were made up of nationally recognized experts in areas such metals behavior in aquatic systems, hydrodynamics, estuarine modeling, ecological effects of trace metals, sediment transport, and atmospheric modeling. The TRCs reviewed the methodological approach and results of the Conceptual Model and the Impairment Assessment reports. The TRC members agreed with the scientific approach and results, and their recommendations were incorporated into the TMDL process. Through these technical reviews, the trust and support of the stakeholders were established and maintained.

4. **Funding and Commitment by the City of San Jose.** The technical assessments could not have been conducted without the funding from the City of San Jose and other dischargers in the Lower South SF Bay.

6 Implementation Plan

This section will introduce the implementation plan (IP) or water quality attainment strategy (WQAS) for copper and nickel to ensure the maintenance of existing ambient copper and nickel levels that are well below the proposed SSOs. The IP includes: 1) a description of the actions to achieve and maintain water quality objectives, including recommendations for appropriate actions public or private entities, 2) a time schedule for the actions to be taken, and 3) a description of the surveillance for determining compliance with objectives. (CWC Section 13242). This section will describe the actions that constitute the IP and how the Regional Board will use its regulatory authority to implement this strategy.

The four elements of the IP for copper and nickel in Lower South SF Bay are:

- Immediately implement current control measures/actions to minimize copper and nickel releases (from POTWs and Urban Runoff Programs) to this waterbody;

- Use statistically-based water quality "triggers" and a receiving water monitoring program that would initiate additional control measures/actions if the "triggers" are reached;

- Use a proactive framework for addressing increases to future copper and nickel concentrations in the Lower South SF Bay, if they occur; and

- Establish metal translators that will be used to compute copper and nickel effluent limits for the POTWs discharging to Lower South SF Bay.

6.1 Monitoring Program Description

A monitoring program requires a water quality indicator -- a measurable quantity strongly associated with environmental conditions such that the value of the measurable quantity can be used to indicate the existence and maintenance of these conditions. The primary indicators for this monitoring program are dissolved copper and nickel concentrations. A possible secondary indicator is copper loading from municipal and industrial sources and in urban and upland runoff. While endpoints or trigger values have not yet been established for the loading indicator, effluent monitoring at Lower South SF Bay POTWs allows an assessment of their contribution.

A complete surveillance program consists of three specific programs: 1) receiving water monitoring, 2) reporting, and 3) response.

- Receiving Water Monitoring Program: Twelve receiving water stations were selected based on historical monitoring programs and records in the Lower South SF Bay. Two upland stations (i.e., Guadalupe River and Coyote Creek) were included to continue to provide tributary data. Dissolved copper and nickel are measured monthly[6]. Further details on the monitoring program are provided below in Section 6.1.

- Reporting Program: The results of the monitoring will be reported as part of the POTWs self-monitoring program. The results of the first South Bay Monitoring Program was published by the City of San Jose in March 2001 (San Jose, 2001b), and no triggers were exceeded.

- Response Program: The IP identifies receiving water "triggers" linked to additional control actions in such a way that exceedance of the triggers is clear evidence that a response or action is required.

6.1.1 Evaluation of Existing Data

Both total and dissolved copper and nickel concentrations have been systematically measured in the Lower South SF Bay since 1989. The most recent data from the City of San Jose's South Bay Monitoring Program were used to evaluate the performance of alternative indicator values. The data included in this analysis were collected bi-weekly at twelve stations in the South Bay (Figure 6-1); triplicate samples were collected at each sampling location and sampling event.

[6] In February 1997, the City of San Jose began sampling total and dissolved copper and nickel at 10 stations in the Lower South Bay. Two upland stations were added October 1997. To date, the City has conducted sixty-eight sampling events and analyzed over 1500 water samples. The City has continued its monitoring program, consistent with the CAP and NAP recommendations and Order No. 00-109 permit conditions.

Both the copper and nickel concentrations at Stations SB11 and SB12, located in Coyote Creek and Guadalupe River, were distinctly different from the concentrations at the stations in Lower South SF Bay, and they were not included in the subsequent analyses. There was a statistically significant difference between the mean values of dissolved copper and nickel measured in the wet season (December – May) and the dry season (June – November). Both the dissolved copper and nickel concentrations measured in the dry season are greater than those measured in the wet season at all stations, and all observed differences are statistically significant. Based on these findings, the dissolved copper and nickel concentrations measured in the dry season were used as the indicators in subsequent analyses.

Preliminary analyses indicate that dissolved copper and nickel concentrations in Lower South SF Bay exhibit characteristics that are requisite for indicators: low variability both temporally and spatially. The use of dissolved concentrations in the dry season has the added benefit that the measurements are less likely to be influenced by natural phenomena, like storm events.

6.1.2 Proposed Monitoring Program Station Locations

The monitoring program will be conducted by the City of San Jose and will consist of dissolved copper and nickel measurements at the ten stations each month. This will give six dry season measurements at each station each year. The dischargers currently define dissolved metal as those metal constituents that pass through a 0.45 micrometer filter prior to chemical analysis. Any changes to this operational definition of dissolved metal will be addressed through the NPDES permit. Stations SB11 and SB12 should continue to be monitored, since they provide valuable information on the contribution of metal loading from the tributaries. The Regional Board reserves the discretion to decrease the sampling frequency or stations sampled through the permitting process. The monitoring program described by this Amendment is to assess ambient conditions compared to the specific trigger levels. These and other ambient monitoring data will be considered to determine compliance with the SSOs.

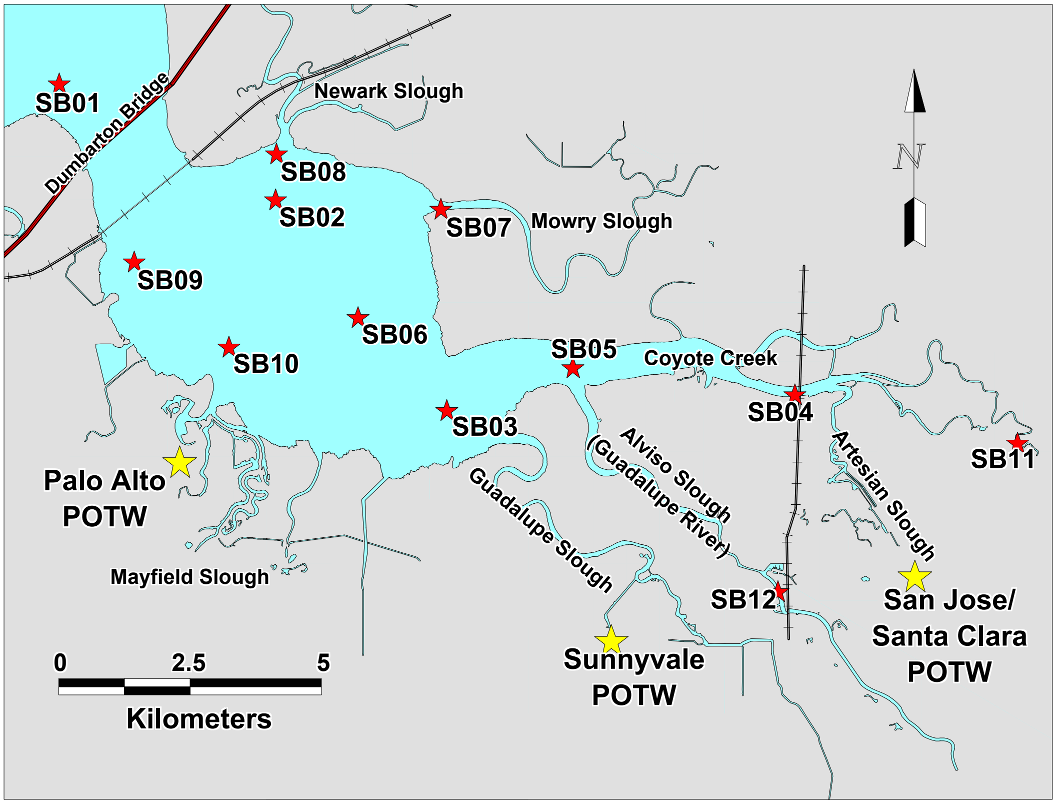

Figure 6-1 Map of monitoring station locations in Lower South SF Bay. This map shows the 12 monitoring stations sampled in the South Bay Study (SBS).

Table 6-1 List of sampling stations to accompany Figure 6-1.

SBS Site ID	Reference Location	Longitude	Latitude	RMP site ID
SB01	Channel Marker #14	37° 30.782'	122° 8.036'	BA30
SB02	Channel Marker #16	37° 29.595'	122° 5.243'	BA20
SB03	Channel Marker #20	37° 27.437'	122° 3.033'	BA10
SB04	Coyote Creek Railroad Bridge	37° 27.600'	121° 58.540'	C-3-0
SB05	Coyote Creek at Guadalupe River confluence	37° 27.875'	122° 1.406'	NA
SB06	Between Channel Markers #17 & #18	37° 28.390'	122° 4.180'	NA
SB07	Mouth of Mowry Slough	37° 29.499'	122° 3.110'	NA
SB08	Mouth of Newark Slough	37° 30.066'	122° 5.231'	NA
SB09	North of Cooley Landing	37° 28.959'	122° 7.068'	NA
SB10	Old Palo Alto Yacht Club Channel Mouth	37° 28.087'	122° 5.846'	NA
SB11	Standish Dam in Coyote Creek	37° 27.150'	121° 55.501'	BW10
SB12	Alviso Yacht Club Dock	37° 25.574'	121° 58.778'	BW15

6.1.3 Evaluation of Indicator Performance

Analyses were performed to examine the inherent variability in the copper and nickel measurements. All ten stations were ranked separately by dissolved copper and nickel concentration from lowest to highest value. Then, the stations with the two lowest and two highest values were removed. For copper, this resulted in six stations (SB03, SB04, SB05, SB07, SB08, and SB09) with dry season dissolved mean concentrations between 3.1 and 3.3 µg/L and relatively low inter-station variability. These stations were chosen as the Indicator Test Stations for copper. For nickel, this resulted in six stations (SB03, SB06, SB07, SB08, SB09, and SB10) with dry season dissolved mean concentrations between 3.4 and 4.6 µg/L and low inter-station variability. These stations were chosen as the Indicator Test Stations for nickel. These stations will be monitored by the City of San Jose at least monthly during the dry season (June to November). The dry season means of the indicated stations will be compared to the first and second trigger levels as described below.

To evaluate the expected performance of the proposed indicators, statistical power analyses were conducted. These analyses provide estimates of the minimum, statistically-significant differences that can be detected between measured values. These analyses showed that, for copper, an increase in dry season dissolved copper concentration of 0.8 µg/L could be reliably detected (greater than 80% power or probability of detection) despite the inherent variability. The copper Phase I trigger is reached and Phase I actions will be conducted if the average dry season dissolved copper concentration at stations SB2, SB4, SB5, SB7, SB8, SB9 increases from 3.2 µg/L (overall dry season mean from indicator stations during the period June 1997 to November 1998) to 4.0 µg/L. The copper Phase II trigger is reached and Phase II actions will be conducted if the dry season mean concentration of the indicator stations increases further to 4.4 µg/L. This 0.4 µg/L change can still be detected with reasonable statistical certainty to justify the more aggressive Phase II actions.

For nickel, an increase in dry season dissolved concentration of 2.0 µg/L could be reliably detected (more than 80% power) despite the inherent variability, and this is the chosen trigger level for nickel. The nickel Phase I trigger is reached and Phase I actions will be conducted if the average dry season dissolved nickel concentration at stations SB3, SB6, SB7, SB8, SB9, SB10 increases from 4.0 µg/L (overall dry season mean from indicator stations during the period June 1997 to November 1998) to 6.0 µg/L. The nickel Phase II trigger is reached and Phase II actions will be conducted if the dry season mean concentration from the indicator stations increases another 2.0 µg/L to 8.0 µg/L. Note that the copper and nickel Phase I and Phase II triggers are well below the proposed site-specific objectives for these metals.

6.2 Quantitative Mass Balance 'Box' Model

A copper and nickel mass-balance model[7] was developed to design the monitoring program portion of the WQAS for copper and nickel in Lower South SF Bay. The simple model does not simulate copper or nickel cycling processes. However, the model can be used to estimate how changing the copper and nickel loading from any particular source would influence both dissolved and total water column concentrations. The response of the dissolved concentrations in Lower South SF Bay to changes in the external loads may be quite small so that loads could either increase or decrease without detectable effect on water column dissolved copper or nickel levels (TetraTech, 2000b and 2000c). The model can also estimate how each source contributes to the observed concentration in the water column.

[7] See Appendix E for a full description of this modeling. More details can also be found in the Copper and Nickel Action Plan reports.

6.3 Copper and Nickel Implementation Actions

This section will describe the actions to be taken to support the copper and nickel SSOs. The underlying goal of these actions is to ensure that copper and nickel loadings to Lower South SF Bay do not increase and that current concentrations of these metals either remains the same or continues to decrease.

The principal mechanisms for implementation of these actions are NPDES permits for POTWs and Municipal Urban Runoff Programs. The implementation actions will be coordinated by the RWQCB in cooperation with other parties.

Importantly, implementation actions that apply to the three Lower South SF Bay POTWs have already been included in their most recent NPDES permits (Order No. 00-108, October 2000). Likewise, the implementation actions that are the responsibility of Lower South SF Bay municipal urban runoff programs were included in their recent NPDES permit (Order No. 01-024, March 2001).

The control actions are divided into the following three categories that are linked to the water quality "triggers" described previously:

- Baseline Actions: These existing actions include 1) programmatic actions by public agencies, 2) tracking special studies that address specific technical areas of uncertainty identified in the Impairment Assessment Report and the Conceptual Model Report (see Section 5.2.2.3 for discussion of uncertainties), 3) planning studies to track, evaluate, and/or develop additional indicators for use as future indicators and triggers (e.g., indicators for growth, development, or increased use or discharge of copper and nickel in the watershed, and water recycling efforts).

- Phase I Actions: These actions are implemented when the values of selected monitoring parameters exceed specified criterion values (referred to as the Phase I Trigger Levels). Exceedance of Phase I Trigger Levels indicates a negative water quality trend rather than actual impairment. Phase I Actions consist of both specific remedial actions and the planning for the implementation of further actions if Phase II Trigger Levels are exceeded.

- Phase II Actions: These will be implemented when the value of selected monitoring parameters exceeds a second-level criterion value (referred to as the Phase II Trigger Levels). These actions are intended to reduce controllable sources further to maintain compliance with site-specific water quality objectives.

For information purposes, all baseline and phased actions are listed in tables in Appendix E. The action tables identify the lead party, give the implementation time-frame, and presents the implementation and reporting mechanism. Within each priority category (e.g. baseline, Phase I, Phase II), the actions are grouped according to the responsible party (e.g. POTWs or Urban Runoff Program). These actions were originally conceived in the Copper and Nickel Action Plans (TetraTech, 2000b, 2000c), and they actions, to the extent that the Regional Board has authority to require them, have already been incorporated into the discharger's NPDES permits.

Some baseline actions are either the joint responsibility of two or more permitted parties or the responsibility of parties not subject to NPDES permits. Because of the importance of these actions to the success of the WQAS and because of the unique accountability challenges, the SCBWMI will take a leadership role. For example, the SCBWMI will partner with the SCVURPPP, the City of Palo Alto and the RWQCB to perform quantification studies on pollution prevention, control measures and source loadings. The SCVURPPP, BASMAA, and the California Stormwater Quality Task Force (SWQTF) will continue to support Brake Pad Partnership activities on the impact of brake pad copper on water quality.

The City of Palo Alto will take the lead in exploring ways to discourage the architectural use of copper and continue its current tracking efforts on corrosion control opportunities and perform educational outreach to plumbers and designers within the City of Palo Alto.

The SCBWMI will be responsible for establishing a forum on transportation issues and impervious surfaces. The SCBWMI will be assisted by the SCVURPPP in implementing measures to improve classification and assessment of watersheds. The SCBWMI will lead an effort to establish an environmental information clearinghouse on copper toxicity, loadings, fate and transport, and impairment of aquatic ecosystems. The SCBWMI with the assistance of POTWs and SCVURPPP will promote targeted studies to reduce the uncertainties associated with the Lower South SF Bay impairment decision and update the findings of the *Conceptual Model Report for Copper and Nickel in Lower South SF Bay* (TetraTech, 1999).

6.4 POTW-specific Implementation Actions: Metal Translators Applicable to Lower South SF Bay

The IP for maintaining the proposed SSOs includes continuation of provisions in the dischargers' NPDES permits that ensure that the treatment facilities continue to perform at highest efficiency. These provisions must also ensure that continuing efforts are being made to control all copper and nickel sources entering the treatment facilities, and that reasonable and cost-effective opportunities to reclaim wastewater are pursued. New concentration-based effluent limits for the three Lower South SF Bay POTWs will be calculated from the proposed chronic copper and nickel SSOs and incorporated into their NPDES permits when those permits are re-issued.

Effluent limits for the POTWs must be calculated according to the procedure outlined in the State Implementation Policy (SWRCB, 2000) of the California Toxics Rule. This procedure calculates an Average Monthly Effluent Limit (AMEL) for the monthly average concentration of a regulated pollutant and a Maximum Daily Effluent Limit (MDEL). Both the AMEL and the MDEL are expressed as total metal concentration. For metals like copper and nickel, the calculation involves use of a ratio of total to dissolved metal called the metal translator.

Analyses of data from 12 monitoring stations in Lower South SF Bay (Dumbarton to sloughs) collected from February 1997 to August 2000 and including dissolved and total copper and nickel, total suspended solids (TSS), and tidal data, revealed a strong relationship between copper and nickel translators and TSS concentrations. The statistical analyses explored relationships between translator values and TSS, tide, site, and season. Linear regression with log-transformed dissolved fraction (translator) and TSS data provided the best regression fit. The best-fit regression line and its 95% confidence intervals provided the basis for translator values for copper and nickel.

USEPA guidance (USEPA Office of Water, June 1996. The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion. EPA 823-B-96-007) states that, when there is a relationship between the translator and TSS, regression equations should be used to develop translator values using representative TSS values the for the site under consideration. There is a fairly wide variation in TSS, and the guidance on translator development suggests using a representative TSS value. In Lower South SF Bay, a median TSS value may not account for the higher translator values and dissolved metal levels that result during high TSS episodes. For this reason, copper and nickel translators computed from 95% confidence interval TSS values were used to develop the POTW effluent limits. A copper translator of 0.53, and a nickel translator of 0.44 resulted from this procedure. Using the 95% confidence interval translator provides an additional measure of beneficial use protection in that effluent limits, expressed at total metal, will be lower using a higher value for metal translators. These translators may be used to compute copper and nickel effluent limits for POTWs discharging to San Francisco Bay South of the Dumbarton Bridge. When NPDES permits for Lower South SF Bay municipal wastewater dischargers are re-issued, the dischargers may submit updated data and analyses for RWQCB consideration of alternative translators. See Appendix D for complete details on how these were developed for Lower South SF Bay.

Tables 6-1 and 6-2 show recent Lower South SF Bay POTW performance for copper and nickel. In Table 6-3, approximate AMEL and MDEL effluent limits for copper and nickel are shown. After the proposed SSOs are adopted, the Regional Board intends to incorporate the water quality-based effluent limits into the NPDES permits during the next permit reissuance for the three Lower South SF Bay POTWs. Considering current performance, it is clear that all three Lower South SF Bay POTWs are in compliance with the effluent limits calculated from the proposed SSOs. Although the proposed POTW effluent limits for copper and nickel are higher than the current interim permit limits, the higher effluent limits will not allow POTWs to relax their treatment levels. This is the case because of other regulatory constraints, namely: (1) the requirement that they must meet concentration-based effluent limitations for other metals, such as cadmium and lead, which are not being relaxed, and it is unlikely that a POTW could differentially relax its treatment of either copper or nickel; and (2) the NPDES permits require that POTWs continue operation and maintenance of the treatment plant at a high degree of reliability. Further, any future proposal to expand capacity of a POTW or to authorize a new source that would result in increases in copper or nickel loadings will be subjected to rigorous antidegradation reviews prior to approval.

Table 6-1 Current Performance for Lower South SF Bay POTWs, Total Copper (based on 1998-2000 data)

POTW	Min (µg/L)	Mean (µg/L)	Max (µg/L)	Coefficient of Variation
San Jose	1.4	3.8	8.8	0.33
Sunnyvale	Non-detect (<1 µg/L)	3.0	8.1	0.54
Palo Alto	1.9	6.5	17.0	0.29

Table 6-2 Current Performance for Lower South SF Bay POTWs, Total Nickel (based on 1998-2000 data) .

POTW	Min (µg/L)	Mean (µg/L)	Max (µg/L)	Coefficient of Variation
San Jose	4.0	6.6	12	0.22
Sunnyvale	Non-detect (< 2 µg/L)	2.7	5.1	0.27
Palo Alto	2.1	4.4	7.7	0.25

Table 6-3 Approximate SIP-Based Effluent Limits for Total Copper and Total Nickel for Lower South SF Bay POTWs. Final permit limits may vary slightly from the ones shown in this table due to updated information on variability of plant effluent concentrations.

POTW	Nickel effluent limits (SSO=11.9 µg/L, trans. = 0.44)		Copper effluent limits (SSO=6.9 µg/L, trans. = 0.53)	
	AMEL (µg/L)	MDEL(µg/L)	AMEL (µg/L)	MDEL (µg/L)
San Jose[1]	23	34	10	18
Sunnyvale[2]	25	36	11	21
Palo Alto[2]	25	35	12	18

[1] AMEL and MDEL calculations based on 13 days/month of POTW monitoring data using procedures in (SWRCB, 2000)
[2] AMEL and MDEL calculations based on weekly data supplied by POTWs using procedures in (SWRCB, 2000)

6.5 Updating the Implementation Plan

The WQAS is an adaptive management plan and should be updated to incorporate lessons learned from action items that have been implemented and scientific and technical information that becomes available in the future. While not a regulatory provision, the suggested update process will make use of the SCBWMI and can be completed as part of the regular review of conditions in Lower South SF Bay at the time NPDES permits are reissued for the SCVURPPP. The WQAS would be updated every five years through the permit process. The update process will begin 360 days prior to NPDES permit reissuance for the SCVURPPP so that the updated results could be incorporated into the reissued POTW and SCVURPPP permits. If revisions are needed prior to the five-year update the Regional Board will so direct through the POTW and SCVURPPP NPDES permits. Modifications to the WQAS may be considered provided that the municipal wastewater dischargers and the SCVURPPP and Co-Permitteess continue reasonable treatment, source control, and pollution prevention measures to control discharges of copper and nickel to the maximum extent practicable. The Action Plan update cycle is as follows:

1. The action plans will be reviewed every five years as part of the NPDES permitting process.

2. The review will be based on an examination of the reports for the Copper and Nickel TMDL Project and the CAP/NAP. The purpose of this review is to evaluate and refine the findings of these documents for modification of the recommended actions. Loading analysis, conceptual model, and impairment assessment uncertainties will be reviewed as additional monitoring and scientific studies become available. CAP/NAP control measures will be evaluated using criteria that include effectiveness, cost, and uncertainty as more experience is gained from application of control measures.
3. Information for the review will come from the dischargers through their monitoring programs and other information gathering requirements of their NPDES permits, and from other public sources.
4. An information clearinghouse will be established to organize and maintain this information. The information clearinghouse set up by the SCBWMI to support its Watershed Action Plan will be considered for this function.
5. The review will be conducted using a collaborative stakeholder CAP/NAP update workgroup similar to the Copper/Nickel TMDL Work Group. Like the TMDL Workgroup it will only last for the time necessary to develop recommendations for RWQCB consideration. The CAP/NAP Work Group would evaluate the compiled information. The review will be based on the TMDL technical reports. The purpose of the review is to incorporate the latest scientific and technical information to continue to reduce uncertainties identified in the TMDL technical reports. The five-year update process ensures that triggers and indicators are consistent with the latest scientific understanding available for Lower South SF Bay. The five-year update will also review the phase priority assigned to each copper or nickel loading control measure. The purpose of the phase priority is to assign each control measure (i.e., action item) to a trigger value that will determine when either planning or implementation will proceed for that measure. The phased priorities are adjusted by the workgroup based on the latest information available on the effectiveness, cost, and uncertainties associated with each control measure. The workgroup consensus recommendations on the TMDL technical reports, trigger levels, and action item priorities will be forwarded to the Regional Board for their consideration and action (e.g., modification of NPDES permits and or the Basin Plan).
6. Affected parties would then implement the CAP/NAP control measures. Control measures that have proven to be ineffective in reducing copper or nickel loading or not cost-effective may be modified or eliminated. Also, new control measures may be added to those that are already in existence.

7 Analysis of Issues and Alternatives for Proposed Amendment

The proposed amendment to the Basin Plan consists of a combination of non-regulatory and regulatory changes. The non-regulatory changes serve to update or clarify Basin Plan language in order to better reflect current Regional Board positions and priorities on a variety of issues, particularly concerning Lower South SF Bay. The only regulatory provisions are to establish site-specific water quality objectives for copper and nickel for Lower South SF Bay and the selection of metal translators as part of the implementation plan to achieve and maintain these objectives. The implementation plan is already required in permits for municipal wastewater and stormwater dischargers in the region.

There are five elements to the proposed amendment to the Basin Plan (numbered project element (1) through (5)). The proposed language for each project element is provided in Appendix A in underline-strikeout format. There are no potentially significant environmental impacts associated with the project. Thus, no alternatives or mitigation measures are proposed to avoid or reduce any significant environmental impacts pursuant to California Code of Regulations, title 14, section 15252. Although it is not required to propose alternatives, in the interest of informed decision-making, an alternatives analysis is presented.

The Impairment Assessment Report (TetraTech, 2000a) suggested a range of scientifically-defensible SSOs both for copper and nickel so numeric values spanning these ranges will be considered as alternatives. There are no meaningful or feasible alternatives for the IP that meet the project objectives, and the details of the IP are independent of the SSO choice. Neither are there meaningful or feasible alternatives for the non-regulatory elements to the basin plan amendment that meet the project objectives. Since, there are no alternatives for individual project elements 2, 3, 4, or 5, the various alternatives for the project as a whole will consist of some specified alternative for project element 1 along with the unique and unchanging set of project elements 2 through 5. The 'no action' alternative will also be considered.

7.1 Potential Adverse Impacts and Feasible Mitigation

The Impairment Assessment Report (TetraTech, 2000a) adequately demonstrated that beneficial uses in Lower South SF Bay are currently not impaired by ambient concentrations of copper and nickel. All values in the range from which the proposed site-specific objectives for copper and nickel is selected are fully protective of beneficial uses in this bay segment. Further, current ambient concentrations are, on average, well below the proposed site-specific objectives and have been on a downward trajectory for the past decade.

As is the case for most questions concerning complex environmental systems, there are some uncertainties. Uncertainties exist with respect both to external metal loading estimates and the degree to which copper and nickel in the sediments continue to contribute to concentrations in the water. The degree to which ambient levels of copper may be impacting certain sensitive phytoplankton species is still an open question as well. In view of these uncertainties, a comprehensive IP was developed to maintain copper and nickel concentrations at current levels. This IP combines pollution prevention actions to keep loadings and concentrations in check and monitoring to provide early warning if concentrations begin to increase so that appropriate actions to reduce loadings may be taken. The proposed project (proposed SSOs plus IP) will thus maintain or improve existing ambient water quality conditions with respect to copper and nickel such that no significant environmental impacts would occur and thus no mitigation measures are required. All possible impacts relevant to this project were considered while preparing the environmental checklist that is available as a separate document in the administrative record for this amendment.

7.2 State Peer Review Requirements

Health and Safety Code, Sect. 57004 requires an external peer review for work products that constitute the scientific basis for a rule "…establishing a regulatory level, standard, or other requirement for the protection of public health or the environment." SB 1320 defines "scientific basis" as "the foundations of a rule that are premised upon, or derived from empirical data or other scientific findings, conclusions, or assumptions establishing a regulatory level, standard or other requirement for the protection of public health or the environment." Under SB 1320, "rule" includes any policy adopted by the State Water Resources Control Board under the Porter-Cologne Water Quality Control Act (Division 7, commencing with Section 13000 of the Water Code) that has the effect of a regulation.

Only project elements 1 and 3 are regulatory and subject to external technical peer review. The comments from the technical peer reviewers, Drs. David Jenkins and Alex Horne from the University of California at Berkeley, concerning the technical basis of these two elements are provided in the administrative record for this amendment along with responses to those comments.

7.3 Brief Description of Project Elements

7.3.1 Project Element 1

Establish specific acute and chronic site-specific water quality objectives for copper and nickel for Lower South SF Bay. These objectives will be incorporated into Table 3-3a in Chapter 3 of the Basin Plan.

7.3.2 Project Element 2

Add new Sections entitled "Water Quality Attainment Strategies including Total Maximum Daily Loads" both at the end of Section "THE WATERSHED MANAGEMENT APPROACH" (Page 4-1) and at the end of the Section "TOXIC POLLUTANT MANAGEMENT IN SEGMENTS OF THE SAN FRANCISCO ESTUARY" (Page 4-4).

The two new sections define TMDLs and water quality attainment strategies (WQAS). They also provide a context by which to understand the particular TMDLs and WQAS that will be incorporated into the Basin Plan as they are completed. Regional Board staff are currently working on a number of TMDLs and WQAS that require distinct approaches, and these sections of the Basin Plan sets the stage for memorializing the outcomes of these various projects in a logical and consistent fashion.

7.3.3 Project Element 3

Create a new section in Chapter 4 entitled 'A WATER QUALITY ATTAINMENT STRATEGY TO SUPPORT COPPER AND NICKEL SITE-SPECIFIC OBJECTIVES SOUTH OF THE DUMBARTON BRIDGE' that will be part of the TMDL/WQAS Section defined in Project Element 2. The Section created through Project Element 3 will define the implementation plan to achieve and maintain the site-specific objectives as set forth under Project Element 1 of the proposed amendment.

The details of the implementation plan that are proposed for inclusion in the Basin Plan are provided in Appendix A with specific actions listed in Appendix E. The proposed SSOs are already being achieved. The program includes a description of the baseline actions for copper and nickel that will insure maintenance of the proposed objectives. There is also a time schedule for the completion of such actions given along with the nature of the actions. Further, this new section of the Basin Plan contains a detailed account of the monitoring program that will provide ongoing surveillance of ambient concentrations of dissolved copper and nickel in Lower South SF Bay. There is also a description of the general manner in which additional implementation actions would be triggered by specific increases (should they occur) in dissolved concentrations of copper and nickel during the dry season. This element also establishes translator values between dissolved and total copper and nickel that will be used to compute NPDES effluent limits for these metals for the three Lower South SF Bay municipal wastewater dischargers. The modifications to Basin Plan language constituting this amendment should not result in any adverse environmental effects since the WQAS contains actions and monitoring designed to prevent degradation of water quality in Lower South SF Bay.

7.3.4 Project Element 4

Update text in section 'BACKGROUND CONCENTRATIONS' on page 4-13 of the current Basin Plan involving language calling special attention to San Francisco Bay south of the Dumbarton Bridge. Two paragraphs of this section would be edited to reflect more accurately current conditions and Regional Board policy concerning Lower South SF Bay. The text has been modified to provide a more accurate statement of Regional Board policy concerning effluent limitations for these POTWs. Because of the substantial improvements to water quality and POTW performance, water quality in this Bay segment is more like the rest of the Bay than it was at the time the current text was included in the Basin Plan. Thus, a more accurate statement of current Regional Board policy is to state that effluent limits contained in Table 4-3 shall apply to Lower South SF Bay POTWs *unless* modifications to water quality objectives are established to warrant consideration of site-specific effluent limitations.

In the second paragraph edited as part of this proposed change, the text has been changed to reflect the fact that the Regional Board *may*, at its discretion, consider site-specific objectives at the request of South Bay dischargers. The text currently implies that the Regional Board *intends* to adopt schedules for developing site-specific objectives for Lower South SF Bay.

7.3.5 Project Element 5

Update text in section 'SOUTH BAY MUNICIPAL DISCHARGERS (SAN JOSE/SANTA CLARA, PALO ALTO, AND SUNNYVALE) on pages 4-19 and 4-20 of the current Basin Plan. The text will be updated to reflect the current status of permitting issues involving these three POTWs in the South Bay below the Dumbarton Bridge.

This section of the Basin Plan should be edited to reflect the current state of Lower South SF Bay POTW permits. The permits for the three POTWs discharging to this Bay segment were amended in October 2000. Thus, much of the text currently in the Basin Plan, last updated in 1995, is outdated. The proposed changes are necessary to remove outdated passages and add text that provides essential information from the new permit. A paragraph is proposed that briefly discusses the new work for copper and nickel that is the main subject for this amendment.

Following that, the text describing provisions for South Bay Municipal Dischargers was modified to reflect the current strategies and policies for these dischargers. These changes include updating the text relating to the prohibition of waste discharge.

7.4 Analysis of Alternatives

Proposed Project:
Chronic SSOs chosen as 6.9 µg/L dissolved copper and 11.9 µg/L dissolved nickel.
Acute SSOs chosen as 10.8 µg/L dissolved copper and 62.4 µg/L dissolved nickel.
The proposed project includes all project elements 2 through 5 as described previously.

The proposed project includes SSOs resulting from the most appropriate and technically justifiable combination of the three contributing factors for the calculation (see Section 5.2.2.2 for details). Although these proposed chronic objectives are higher than the current CTR chronic objectives, they are within the scientifically-defensible range deemed protective of the designated beneficial uses of Lower South SF Bay. Lower South SF Bay is already achieving these objectives, and ambient water quality will be protected from degradation through the implementation plan to maintain these objectives.

No Action: Under this 'no action' alternative, project elements 1 through 5 would not be completed. The applicable copper and nickel water quality objectives for Lower South SF Bay would remain those from the California Toxics Rule (CTR). The dissolved copper chronic and acute objectives from the CTR are 3.1 µg/L and 4.8 µg/L, respectively. The dissolved nickel chronic and acute objectives from the CTR are 8.2 µg/L and 74 µg/L, respectively. These objectives are not routinely met in Lower San Francisco Bay. This is true despite the substantial improvements in treatment performance on the part of POTWs discharging to this Bay segment and reasonable efforts on the part of the urban runoff programs at controlling their contribution to loading of these metals to the bay as well.

In order for ambient concentrations in Lower South SF Bay to be lowered below the CTR objectives, substantial and potentially costly efforts would be required on the part of POTWs and urban runoff programs. Significantly, such efforts would not necessarily result in a meaningful water quality benefit. Even with such efforts, it is not certain that this Bay segment would be able to meet the CTR objectives because of the role of the sediments in contributing to ambient concentrations of dissolved copper and nickel. The Impairment Assessment Report concluded that Lower South SF Bay is not currently impaired by ambient concentrations of dissolved copper and nickel. Since beneficial uses would be fully protected by site-specific objectives that are achievable without potentially costly actions on the part of POTWs and urban runoff programs, the 'No Action' alternative is not consistent with the stated project objectives and is not recommended.

Project Alternative 1:
Chronic SSOs chosen as 5.0 µg/L dissolved copper and 11.9 µg/L dissolved nickel.
Acute SSOs chosen as 7.8 µg/L dissolved copper and 62.4 µg/L dissolved nickel.
This project alternative includes all project elements 2 through 5 as described previously.

Under this alternative, the acute and chronic site-specific water quality objectives in Lower South SF Bay for dissolved copper and nickel would be chosen as the lower ends of the scientifically-defensible ranges. This alternative does not meet the project objectives for copper in two important respects. The lower end of the SSO range for copper resulted from the use of toxicity data from a resident species database. Use of this resident database that only considers those species in the national database that are resident in San Francisco Bay does not account for several ecological niches that are included in the national database. Thus, this SSO choice is not based on the best and most relevant set of data. Also, POTWs would be likely be compelled to upgrade their facilities to comply with this ambient water quality objective although they are already operating at reasonably high levels of performance. Because two of the project objectives are not met under this alternative, it is not recommended.

Project Alternative 2:
Chronic SSOs are 12 µg/L dissolved copper and 21 µg/L dissolved nickel.
Acute SSOs are 14.3 µg/L dissolved copper and 62.4 µg/L dissolved nickel.
This project alternative includes all project elements 2 through 5 as described previously.

Under this alternative, the acute and chronic site-specific water quality objectives in Lower South SF Bay for dissolved copper and nickel would be chosen as the upper ends of the scientifically-defensible ranges. This alternative conflicts with the project objective that the objectives should be no higher than necessary. It has already been demonstrated that the proposed alternative meets all the project objectives including beneficial use protection. It is not necessary to consider SSOs higher than the proposed alternative so this alternative is not recommended.

8 Regulatory Analyses

Under the State Board's regulations implementing CEQA, it is required that this report:

1. Provide a brief description of the proposed project (here, the Basin Plan amendment).
2. Consider reasonable alternatives to the proposed amendment;
3. Describe mitigation measures to minimize any potential significant adverse environmental impacts of the proposed activity.

The description of the proposed project is set forth in Section 4 of this report. The alternatives analysis and assessment of adverse environmental impacts was presented in Section 7. The Administrative Procedures Act requires that the Office of Administrative Law review proposed regulations (here, the regulatory provisions of the proposed Basin Plan amendment) for necessity. Section 4 demonstrates the need for the proposed regulatory provisions of the Basin

Plan. California Water Code Section 13241 requires the consideration of certain factors in adopting new water quality objectives. Each of these factors is discussed below.

Finally, consideration must be given to State and federal antidegradation requirements. This consideration is set forth below.

For each analysis considered, where the bulk of the supporting material was presented previously in this report, it is not repeated here. When appropriate, the section of the report containing more details are identified.

California Water Code Section 13241 Factors Past, Present and Probable Future Beneficial Uses

The current Basin Plan defines beneficial uses and water quality objectives for waters of the State in the San Francisco Bay Region, including surface waters and groundwaters. The beneficial uses cited in Chapter 2 of the 1995 Basin Plan applicable to Lower South SF Bay are listed below.

- Water Contact Recreation
- Non-Contact Water Recreation
- Wildlife Habitat
- Preservation of Rare and Endangered Species
- Estuarine Habitat
- Fish Migration
- Fish Spawning (Potential Use)
- Industrial Service Supply
- Shellfish Harvesting
- Navigation
- Commercial and Sport Fishing

These beneficial uses adequately represent past, present and probable future uses, and they provided the basis of the copper and nickel impairment assessment performed as part of this project (TetraTech, 2000a).

The impairment assessment relied on a “weight of evidence” technical approach. Following this approach, all available evidence was reviewed and incorporated in proportion to its applicability, technical certainty, and statistical validity in evaluating the likely impacts and impairment of beneficial uses. The indicators of impairment and lines of evidence used in this assessment are described above in Section 5 of this report. After considering several lines of evidence, impairment of beneficial uses due to ambient concentrations of copper and nickel was considered unlikely. This finding requires clear support from more than one line of evidence and is based on a substantial amount of laboratory and or environmental data. This level of finding does include uncertainties regarding the finding as described previously. The proposed objectives are fully protective of the most sensitive beneficial uses, those pertaining to aquatic life (e.g. ‘estuarine habitat’, ‘shellfish harvesting’, and ‘fish migration’, ‘sport fishing’) and are thus deemed protective of all other past, current and future beneficial uses set forth above (TetraTech, 2000a).

Environmental Characteristics of the Hydrographic Unit Under Consideration, Including the Quality of Water Available Thereto; and Water Quality Conditions that Could Reasonably Be Achieved Through the Coordinated Control of All Factors Which Affect Water Quality in the Area

Both of these were important factors in deciding that site-specific objectives should be considered for Lower South SF Bay. Both will now be analyzed simultaneously.

As noted previously in Section 3 this report, much progress has been made in recent years on the part of POTWs and Urban Runoff Programs in controlling copper and nickel loading to Lower South SF Bay. This progress is reflected in the decreasing trend in water column concentrations as well (see Section 3.5 for details). However, the watershed draining to this shallow southern portion of San Francisco Bay is heavily urbanized, and in this Bay segment there is limited flushing with freshwater. Further, despite the fact that there are ongoing efforts by POTWs and urban runoff programs to control loadings of these metals to Lower South SF Bay, a substantial amount of copper and nickel remains in the sediments from historical and current discharges. This residual mass in the sediments largely accounts for why current water column concentrations of copper and nickel still exceed the applicable water quality objectives. This residual metal also means that water column concentrations are less responsive to decreases in external loadings than would be the case with lower concentrations of metals in the sediments. Yet, the water column concentrations have been decreasing, and they are expected to decrease further if loadings are kept in check. Section 5 of this report mentions that the chemical environment of an estuary such as Lower South SF Bay tends to reduce the toxicity of metals like copper and nickel through a variety of mechanisms (TetraTech, 1999).

Section 6 of this report describes a WQAS that was developed to support the SSOs, and this plan is ample evidence that there are coordinated efforts to control factors that affect water quality. These efforts are already underway and will be continued in the future. The strategy also includes surveillance to insure that the efforts are being sustained and that water quality is maintained. The monitoring program is designed to detect very small changes in dry season dissolved nickel and copper concentrations in Lower South SF Bay. According to the implementation plan, more aggressive pollution prevention actions, beyond the current baseline activities, would be triggered by small increases in dissolved concentrations well below the proposed site-specific objectives.

Although the recommended SSOs are higher than current dissolved concentrations of copper and nickel, RWQCB cannot arbitrarily select SSOs to be just higher than current ambient concentrations. Rather, the SSO choice is constrained by the requirement to use calculation procedures established by the USEPA (SWRCB, 2000). Using those established procedures resulted in scientifically-defensible ranges both for copper and nickel from which the recommended SSOs were chosen as described in Section 5.2.2.2. However, it is important to note that the implementation plan will hold ambient concentrations at current levels.

Economic Considerations

CWC §13241 is interpreted as requiring, at a minimum, a review of available information to determine whether:

- The proposed water quality objective is currently being attained; or if not,
- What methods are available to achieve compliance with the water quality objective and the costs of those methods of compliance.

There are minimal economic impacts that would result from this amendment. The proposed site-specific water quality objectives for copper and nickel are currently being met in the receiving water so no additional treatment measures are necessary to achieve compliance with the proposed objectives. Also, as shown in Section 6.4, the POTW effluent limits that are calculated from the site-specific objectives according to the SIP methodology are well above current performance so no additional treatment is required to meet such objectives. By contrast, the 'no action' alternative in which the CTR objectives would remain in place would constitute a compliance challenge for both the POTWs and urban runoff programs and could require substantial expenditures to ensure compliance.

In addition to the CWC §13241 economic analysis requirements, CEQA requires that whenever a State or regional board adopts rules that require the installation of pollution control equipment or establish a performance standard or treatment requirement, the board must conduct an environmental analysis of the reasonably foreseeable methods of compliance [Pub. Res. Code §21159, 14 CCR 15064]. It has already been demonstrated that POTWs will be able to comply with the effluent limits computed from the proposed water quality objectives for copper and nickel.

The Need for Developing Housing Within the Region

While preparing this Basin Plan amendment, the Regional Board considered the ongoing need to develop housing in this region – a region that is home to Silicon Valley and one that has seen rapid population and economic growth over several decades. When a region experiences population growth, the increased strain on services and infrastructure can require an expansion or upgrading of such services or infrastructure. In our view, the service most likely to be directly affected by this amendment is the treatment of wastewater at the three Lower South SF Bay POTWs. The following discussion explains why the proposed project will not constrain the operation of wastewater treatment facilities in the region and, thus, will not adversely impact the development of housing within the region.

The proposed SSOs relax the current applicable water quality objectives for both copper and nickel. Current ambient concentrations in Lower South SF Bay are well below the proposed site-specific objectives. Current POTW performance is much better than the effluent limits that would result from the proposed site-specific objectives. Further, by proposing revised water quality objectives, the Regional Board recognizes that this segment of the Bay can now assimilate some increased loading without substantial increases in concentrations. It is estimated that an additional 650 kg (TetraTech, 2000b) of dissolved copper would have to be discharged to Lower South SF Bay in order to increase the dry season dissolved concentration by 0.8 μg/L (the Phase I copper trigger level). It is estimated that an additional 1625 kg (TetraTech, 2000c) of dissolved nickel would have to be discharged to Lower South SF Bay in order to increase the dry season dissolved concentration by 2.0 µg/L (the Phase I nickel trigger level)[8]. Thus, if POTWs maintain their current good performance and urban runoff programs remain committed to pollution prevention and source control, there is no reason to believe that the proposed site-specific objectives for copper and nickel would negatively impact the need for developing housing within the region since compliance with such objectives would not be a limiting factor in decisions to upgrade or expand treatment facilities. There are many considerations to take into account in making the decision to expand wastewater treatment facilities due to population growth. Generally, such facilities are expanded to accommodate increased wastewater flow. Because it has been demonstrated that the revised water quality objectives allow some room for increased loadings (the 'no action' alternative for the site-specific objectives would not) without jeopardizing water quality or beneficial uses, this Amendment will not aversely impact the development of housing in the region.

The Need to Develop and Use Recycled Water

The three Lower South SF Bay POTWs in this region have water recycling or reclamation programs in place. If the total amount of wastewater that was recycled or reclaimed during 1999 and 2000 were expressed on a daily basis, it would total more than 4.5 million gallons per day[9]. These facilities are currently reclaiming or recycling more than 2 % of the influent[10]. These programs produce a valuable commodity – high quality water in a water scarce region. Consequently, all three programs are undergoing expansion to meet the growing demand for the high quality water they produce.

Adopting the recommended site-specific objectives for copper and nickel will have a minimal impact on the quality and no impact on the quantity of wastewater available for recycling or reclamation in the region. There could be small increases in concentrations of copper and nickel in the effluent from the three Lower South SF Bay wastewater treatment plants. However, effluent quality in the future is likely to be comparable to current effluent quality since the level of treatment will remain identical or improve. These three POTWs are among the best performing facilities in the entire nation[11], and there is currently no water quality limitation on water recycling or reclamation programs, and none are envisaged for the future. In fact, water recycling and reclamation programs are certain to expand in the future.

8.1 Antidegradation

Before a water quality objective can be relaxed, careful consideration must be given to state and federal antidegradation requirements. Each of the State and federal requirements will be considered in the following sections.

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[8] Estimates provided in the Copper and Nickel Action Plans

[9] These volumes were summarized from the annual reports for the reclamation or recycling programs for the three Lower South SF Bay POTWs for the years 1999 and 2000 (EOA 2000a, 2001; San Jose 2000, 2001a, Palo Alto 2000, 2001).

[10] Based on dividing 4.5 million gallons per day by the average daily effluent during the dry season during years 1998-2000. This is an approximation used for purposes of illustration.

[11] The San Jose/Santa Clara Water Pollution Control Plant won the USEPA National Operations and Maintenance Excellence Award in the category of large advanced wastewater treatment plants in 2000.

8.1.1 State Requirements

Relaxation of water quality objectives must conform to State Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality of Water in California." It must be demonstrated that the change in water quality owing to relaxing the water quality objective:

- Will be consistent with maximum benefits to the people of the State;
- Will not unreasonably affect present and anticipated beneficial use of such water;
- Will not result in water quality lower than that prescribed in the applicable policies; and
- Will ensure that dischargers will implement the best practicable treatment or control.

After weighing several lines of evidence, impairment of beneficial uses due to current ambient concentrations of copper and nickel was considered unlikely (TetraTech, 2000a). The proposed copper and nickel site-specific objectives were selected from ranges of possible objectives that were scientifically-defensible and protective of beneficial uses in Lower South SF Bay. An implementation plan was designed to maintain these proposed site-specific objectives and put actions in place that should prevent concentrations of copper and nickel from ever reaching the proposed site-specific objectives so that beneficial uses will be fully protected in the future. Further, the implementation plan ensures that the current high level of performance from the POTWs and urban runoff programs (described in Sections 3.3 and 3.4 of this report) will continue, and this high level of current performance is considered the best practicable treatment or control of waste discharges to the water body.

The proposed site-specific objectives are more than adequate to protect beneficial uses, and they provide a measure of regulatory relief for Lower South SF Bay POTWs and urban runoff programs. This relief stems from the fact that there is no longer a need to conduct a complete TMDL project with load allocations that could result in more restrictive POTW permit effluent limits. In this particular case, the regulatory easement provided by the site-specific objectives is justified for several reasons: because the site-specific objectives are scientifically sound and protective of beneficial uses; because of the unique environmental conditions described in Sections 3.1 and 3.2 of this report; and because of the generally excellent performance on the part of Lower South SF Bay POTWs and historically good performance and ongoing commitment to pollution prevention actions on the part of municipal urban runoff programs in the region. While relaxing ambient water quality objectives for copper and nickel may create the potential for increases in loadings of copper and nickel, this is unlikely to occur if current performance by area dischargers is maintained as is expected and required in their permits.

Relaxing the water quality objectives for copper and nickel is consistent with the maximum benefit to the people of the State because beneficial uses will be fully protected without requiring an unreasonable level of performance on the part of dischargers that are already achieving generally outstanding levels of performance. Further, requiring a higher level of performance for copper or nickel treatment on the part of Lower South SF Bay POTWs would not result in substantial improvement in ambient water quality or beneficial use protection because beneficial uses are not being impaired by current concentrations of copper or nickel.

In general, existing federal and state policies aim to ensure that all relevant beneficial uses are fully protected. The proposed site-specific objectives will not result in water quality lower than that prescribed in such policies.

8.1.2 Federal Requirements

The federal regulations covering antidegradation (40 CFR 131.12) divide waters into three categories or tiers. Tier 1 waters[12] are those that are not meeting the federal "fishable/swimmable" goals. Tier 2 waters are those where the water quality is better than the minimum necessary to maintain "fishable/swimmable" uses. Tier 3 waters are outstanding national resource water such as National and State parks and wildlife refuges or waters of exceptional recreational or ecological significance.

Lower South SF Bay currently meets the requirements for Tier 2 because water quality is better than the minimum necessary to maintain "fishable/swimmable" uses. Current ambient concentrations of copper and nickel are below the level necessary not only to meet the "fishable/swimmable" uses but all designated beneficial uses. The Impairment Assessment Report (TetraTech, 2000a) provides the justification that beneficial uses will be fully protected by the proposed chronic SSOs for dissolved copper (6.9 µg/L) and dissolved nickel (11.9 µg/L). Average dry season concentrations of these two metals in Lower South SF Bay are generally higher than the average wet season concentrations, and the average dry season copper concentration from 1997-2000 was 3.3 µg/L, less than one-half the proposed copper SSO. The average dry season nickel concentration from 1997-2000 was 4.0 µg/L, one-third the proposed nickel SSO. Further, the highest single day event average across the relevant monitoring stations measured since 1997 is 3.94 µg/L dissolved copper and 5.88 µg/L dissolved nickel (San Jose, 2001b). Based on this comparison of current conditions with the proposed SSOs, Lower South SF Bay would still meet the Tier 2 requirements under the proposed SSOs. Even if Lower South SF Bay copper and nickel concentrations were equivalent to the proposed SSOs, the waterbody would still meet the Tier 2 requirements because the proposed SSOs are fully protective of all beneficial uses.

It has been demonstrated that Lower South SF Bay is currently a Tier 2 water body, and current ambient concentrations of copper and nickel are lower than the proposed SSOs. As such, relaxing the water quality objectives for these metals by establishing the SSOs may, on its face, be viewed as lowering water quality. However, it is important to keep in mind that the implementation plan is designed to prevent any substantial *actual lowering* of water quality as measured by increases in dissolved levels of copper and nickel during the dry season.

In any event, lowering of water quality (e.g. relaxing a standard) may be done only after satisfying public participation requirements, and if the Regional Board finds that (1) the relaxation of the standard is necessary to accommodate important economic or social development in the area in which the waters are located; and (2) the revised water quality objective is adequate to fully protect existing beneficial uses; and (3) the highest statutory and regulatory requirements will be imposed on all new and existing point sources and all cost-effective and reasonable best management practices will be required for nonpoint source control. 40 CFR 131.12. Each of these three conditions will now be considered in turn.

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[12] According to EPA guidance, Questions and Answers on Antidegradation, 1985, Tier 1 waters are those where there is any existing use that is not being met, whether that use is fishable/swimmable or not.

(1) The relaxation of the standard is necessary to accommodate important economic or social development in the area in which the waters are located.

In the case of the proposed copper and nickel site-specific objectives, the impact on water quality is expected to be minimal. Although the proposed water quality objectives are higher than the current objectives from the CTR, ambient concentrations of these metals have been decreasing over the last decade and are currently well below the site-specific objectives. In the future, it is expected that ambient concentrations will remain similar to current levels or continue to decrease due to the actions required by the implementation plan. If not, the monitoring component of the implementation plan will provide warning well in advance of an increase up to the site-specific levels (refer to Figures 8-1 and 8-2 below). The expected actual change to water quality resulting from adopting the copper and nickel SSOs will be minimal if anything at all.

This region of California is the center of the high technology electronics industry and an essential part of the California economy. Population growth has been occurring and will likely continue to occur. The watershed that drains to Lower South SF Bay has been heavily urbanized for at least two decades. Because of ongoing and historical anthropogenic activities that caused high copper and nickel loading, the sediments of this portion of SF Bay are enriched in copper and nickel. The quantitative mass balance model (described in Appendix C) that was used in developing the Copper and Nickel Action Plans (TetraTech 2000a, 2000b), suggests that the metal in the sediments contributes substantially to the ambient concentrations and that even drastic decreases in external loadings would have a small effect on the ambient concentrations, at least in the near term.

Due to the generally excellent performance of POTWs, urban runoff programs and the impact of source control efforts in the region, substantial improvements in loading decreases and ambient conditions have been realized over the last ten years. Much of the contribution to current dissolved levels comes from metal already in the sediments from historical activities, and dischargers to this portion of SF Bay are already operating at very high levels of performance. Substantially higher performance by dischargers would be required to meet the current water quality objectives. The higher performance would likely require costly improvements to treatment facilities without a discernible benefit in water quality since all designated beneficial uses would be fully protected at ambient concentrations somewhat higher than the current water quality objectives. The costs for upgrading these facilities will not be absorbed by the municipalities in which they operate, but will rather be passed on to regional ratepayers in the form of higher sewerage service costs. These higher rates will logically have a disproportionate impact on lower income families who already face prohibitively high housing costs in this region. While there are no economic or social activities uniquely accommodated by the current water quality objectives for copper and nickel in this portion of SF Bay, the SSOs would accommodate important economic and social development through avoidance of higher utility rates by lower income families. This is especially important in a region that has experienced displacement of lower income families into outlying areas. This trend causes strain on transit infrastructure by those who have migrated elsewhere for less expensive housing but continue to commute into the region for employment.

The Regional Board requires that the dischargers maintain their current performance, comply with all required actions of the implementation plan, and look for improvements in performance where appropriate. The combination of the proposed site-specific objectives and implementation plan will protect water quality and accommodate current and future economic activity and population growth. These two goals can be accomplished while ensuring that little or no actual lowering of water quality will occur despite relaxing the water quality objectives for copper and nickel.

(2) The water quality objective is adequate to fully protect existing beneficial uses.

For the proposed copper SSOs, the argument assumes that if the aquatic species most sensitive to copper is not impacted by ambient dissolved copper concentrations equivalent to the SSO, the other aquatic species less sensitive to copper will not be impacted either. Further, all beneficial uses will be fully protected if beneficial uses relating to aquatic life (uses most sensitive to copper and nickel) are protected. The proposed chronic and acute copper SSOs are low enough to protect *Mytilus edulis* (blue mussels), the most sensitive species in the national database tested for copper toxicity. The toxicity of copper in Lower South SF Bay is reduced by the presence of dissolved organic compounds that bind the copper making it less bioavailable and the presence of metals like manganese or iron that compete with copper for receptor sites on or in the organism (TetraTech, 2000a).

For nickel, the proposed SSOs were computed in accordance with USEPA-recommended methods designed expressly to protect aquatic life. Because the beneficial uses most sensitive to nickel, those relating to aquatic life, would be protected by the proposed nickel SSOs, all other less sensitive beneficial uses would be protected as well. Site-specific case studies for San Francisco Bay and Lower South SF Bay demonstrated that nickel toxicity is less in ambient site-water than predicted by the national water quality criteria, possibly because of the organic binding of nickel and the presence of metals like manganese and iron that compete with nickel for receptor sites on or in the organism (TetraTech, 2000a).

(3) The highest statutory and regulatory requirements will be imposed on all new and existing point sources and all cost-effective and reasonable best management practices will be required for nonpoint source control.

Existing point sources (municipal and industrial discharges) will be expected to maintain their current high level of performance, and any new point sources will be expected to perform up to this standard as well. In fact, the NPDES permits require the Lower South SF Bay POTWs to maintain their plants at peak efficiency, and this requirement implies maintaining current treatment performance. The municipal urban runoff programs are currently implementing cost-effective and reasonable best management practices, and the implementation plan to support the proposed site-specific objectives requires them to maintain strong pollution prevention actions and seek ways to improve their program efficiency as well.

8.1.3 The Implementation Plan Protects Against Water Quality Degradation

Although the proposed Amendment relaxes the copper and nickel water quality objectives, the IP actions are designed to prevent *any actual degradation* of water quality stemming from increases in ambient concentrations of copper and nickel in Lower South SF Bay. If the Phase I "triggers" are reached, the implementation plan contains aggressive pollution prevention actions on the part of POTWs and Urban Runoff Programs in order to keep ambient concentrations under control and avoid further increases. These Phase I triggers are well below the proposed site-specific objectives so aggressive action would be taken well in advance of reaching the concentrations that might pose a threat to beneficial uses. Figures 8-1 and 8-2 help illustrate this point by showing recent data from the Lower South SF Bay monitoring stations in comparison to the Phase I and II triggers and the proposed site-specific objectives. The data plotted are the averages of the six stations that will be used to determine if the trigger levels are reached during the dry season (June to November). Current copper concentrations are below the applicable Phase I trigger, and current nickel concentrations are well below the applicable Phase I trigger. The Regional Board expects future data to be similar and continue the downward trend. However, if the situation reverses, concentration increases will be signaled well in advance of a threat to beneficial uses, and aggressive pollution prevention and source control actions will be put in place to control ambient concentrations.

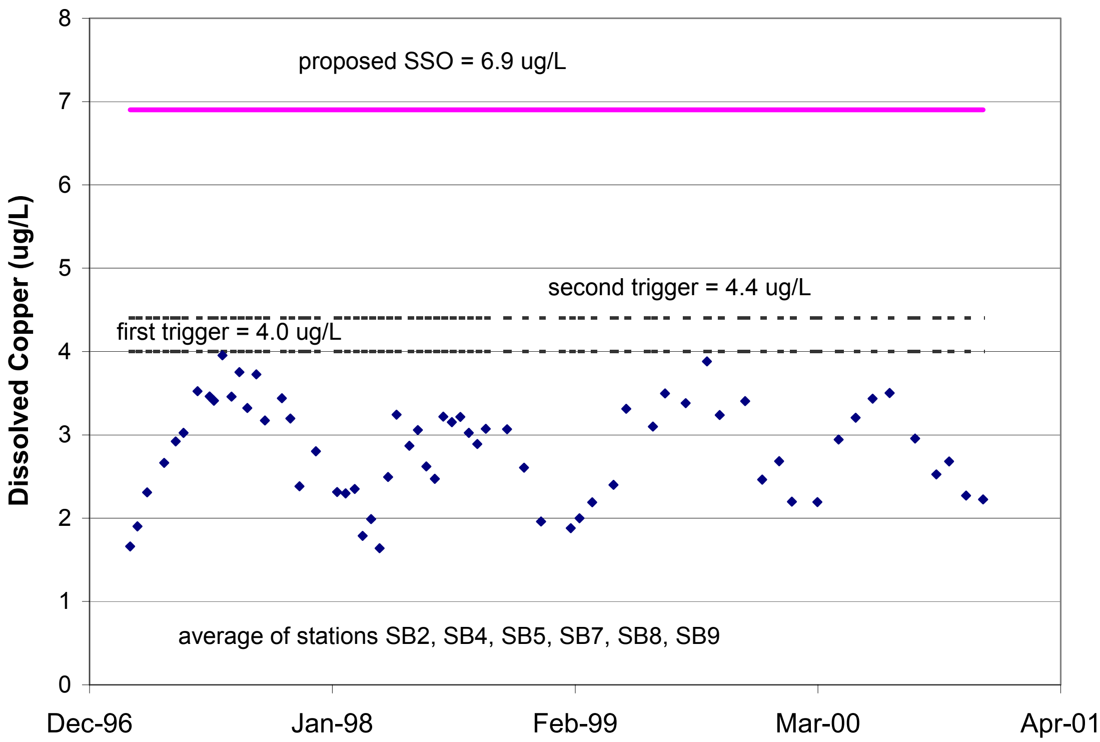

Figure 8-1 Plot of recent dissolved copper monitoring data averaged from the six Lower South SF Bay stations that will be used to determine if the trigger levels are reached. These data are shown in comparison to the trigger levels and the proposed site-specific objective for copper.

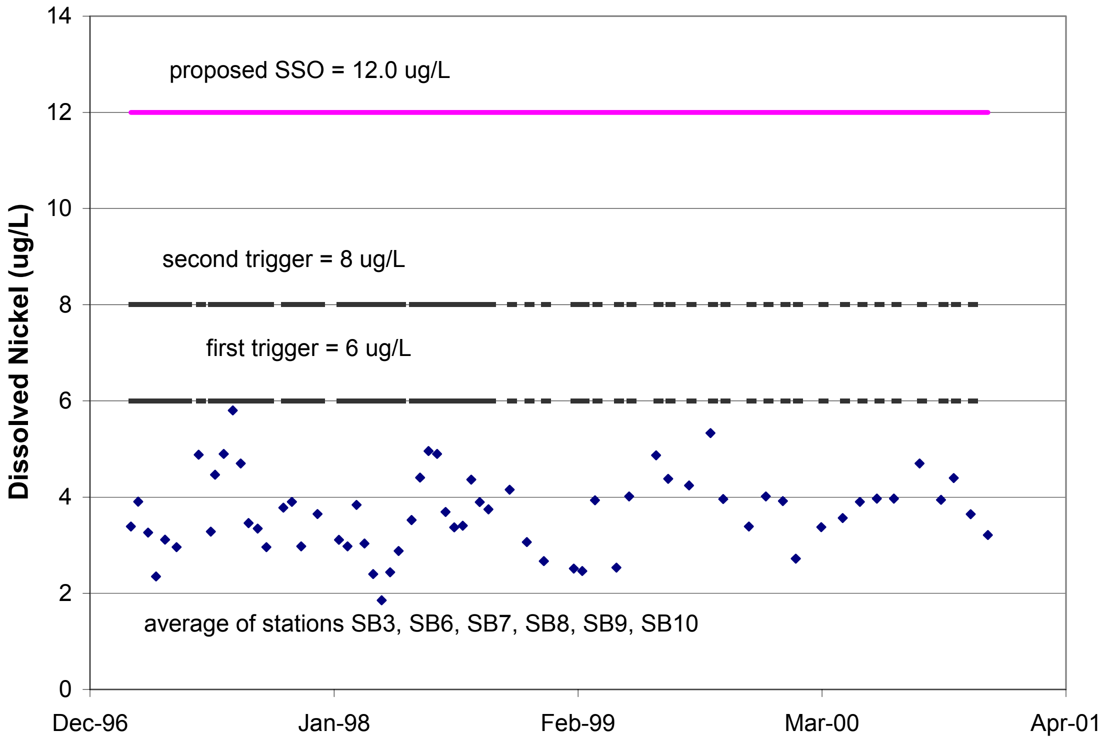

Figure 8-2 Plot of recent dissolved nickel monitoring data averaged from the six Lower South SF Bay stations that will be used to determine if the trigger levels are reached. These data are shown in comparison to the trigger levels and the proposed site-specific objective for nickel.

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Appendix A: Proposed Changes to the San Francisco Bay Water Quality Control Plan

(underline strikeout versions) to Incorporate the Lower South SF Bay SSOs for Copper and Nickel and Associated Water Quality Attainment Strategy.

Project Element 1 – Merge with Chapter 3 Section on Water Quality Objectives for Toxic Pollutants

TABLE 3-3A WATER QUALITY OBJECTIVES FOR COPPER AND NICKEL IN LOWER SOUTH SAN FRANCISCO BAY

All values in µg/L dissolved unless otherwise noted:

Compound	**4-day average (CCC)[1]**	**1-hr average (CMC)[2]**	**Extent of applicability**
Copper	6.9	10.8	Marine and Estuarine[3] Waters Contiguous to SF Bay, South of Dumbarton Bridge
Nickel	11.9	62.4[*]	Marine and Estuarine Waters Contiguous to SF Bay, South of Dumbarton Bridge

[*] Handbook of WQS, 2nd ed. 1994 in Section 3.7.6 states that the CMC = Final AcuteValue/2; 62.4 is the Final Acute Value (resident species database)/2; so the site-specific CMC is lower than the California Toxics Rule value because we are using the resident species database instead of the National Species Database.

[1] Criteria Continuous Concentration

[2] Criteria Maximum Concentration

[3] Marine and Estuarine Waters are distinguished from freshwater by a salinity threshold that is currently 5 ppt but is subject to modification.

Project Element 2 – *Add at end of section called* "THE WATERSHED MANAGEMENT APPROACH" (Page 4-1):

Water Quality Attainment Strategies Including Total Maximum Daily Loads

The Regional Board intends to establish Water Quality Attainment Strategies (WQAS) including Total Maximum Daily Loads (TMDLs) where necessary and appropriate to ensure attainment and maintenance of water quality standards. Section 303(d) of the federal Clean Water Act requires states to identify water bodies that are not attaining water quality standards, and to establish TMDLs for pollutants causing the impairment (non-attainment of water quality standards) of listed water bodies. As such, TMDLs are the pollutant load levels necessary to attain the applicable water quality standards. A complete TMDL refers to the process and elements associated with establishing a TMDL that include, but are not limited to, problem statement, numeric target(s), source analysis, linkage analysis, wasteload and load allocations, implementation plan, and monitoring plan.

Water Quality Attainment Strategies are development and implementation actions associated with implementing (attaining) water quality standards. Complete TMDLs are WQAS, but

WQAS are not limited to 303(d)-list pollutants. For example, they may be developed for pollutants for which threat of impairment provides cause for pollution prevention actions and related activities. WQAS may contain, but not necessarily include, all or some of the complete TMDL elements.

The Regional Board will establish Water Quality Attainment Strategies including TMDLs at the level (larger San Francisco Estuary, smaller segments within the Estuary, or individual watersheds) deemed most appropriate in terms of effectiveness and efficiency relative to the applicable water quality standard, types and locations of pollutant sources, and type and scale of implementation actions.

Project Element 2 (continued) – Add to end of section called "TOXIC POLLUTANT MANAGEMENT IN SEGMENTS OF THE SAN FRANCISCO ESTUARY" (Page 4-4):

Water Quality Attainment Strategies Including Total Maximum Daily Loads

Water Quality Attainment Strategies (WQAS) including Total Maximum Daily Loads (TMDLs) deemed necessary and appropriate to ensure attainment and maintenance of water quality standards in segments of the San Francisco Estuary are presented herein this section.

Project Element 3 – insert new Section in Chapter 4 Add to end of section called "TOXIC POLLUTANT MANAGEMENT IN SEGMENTS OF THE SAN FRANCISCO ESTUARY" (Page 4-4):

Water Quality Attainment Strategies including Total Maximum Daily Loads

Project Element 3 – insert new Section in Chapter 4 Add to end of section called "TOXIC POLLUTANT MANAGEMENT IN SEGMENTS OF THE SAN FRANCISCO ESTUARY" (Page 4-4):

Water Quality Attainment Strategies including Total Maximum Daily Loads

A WATER QUALITY ATTAINMENT STRATEGY TO SUPPORT COPPER AND NICKEL SITE-SPECIFIC OBJECTIVES SOUTH OF THE DUMBARTON BRIDGE

The Water Quality Attainment Strategy (WQAS) for copper and nickel in San Francisco Bay south of the Dumbarton Bridge (Lower South SF Bay) is designed to prevent water quality degradation and ensure the ongoing maintenance of the site-specific objectives both for copper and nickel in Lower South SF Bay. This section describes the details of the WQAS and how the Regional Board will use its regulatory authority to implement this strategy.

The four elements of the WQAS for copper and nickel in Lower South SF Bay are:

- Current control measures/actions to minimize copper and nickel releases (from municipal wastewater treatment plants and urban runoff programs) to Lower South SF Bay;

- Statistically-based water quality "triggers" and a receiving water monitoring program that would initiate additional control measures/actions if the "triggers" are met;

- A proactive framework for addressing increases to future copper and nickel concentrations in Lower South SF Bay, if they occur; and

- Metal translators that will be used to compute copper and nickel effluent limits for the municipal wastewater treatment plants discharging to Lower South SF Bay.

Except for the specification of metal translators, all actions and monitoring obligations described in this section have been required by the National Pollutant Discharge Elimination System (NPDES) permits for the three municipal wastewater dischargers and the municipal urban runoff (stormwater) dischargers in Lower South SF Bay since October 2000 and March 2001, respectively.

I. Background

Lower South SF Bay has been listed as impaired due to point source discharges of generic metals since 1990 (USEPA Clean Water Act §304(l) listing) and most recently for copper and nickel from point and urban runoff sources in the State of California's 1998 Clean Water Act §303(d) list. The primary reason for the copper and nickel impairment listings had been that ambient water concentrations of dissolved copper and nickel exceeded Basin Plan water quality objectives or US EPA national water quality criteria for the protection of aquatic life. Despite significant reductions in wastewater loadings over the past two decades, ambient concentrations at stations monitored through the San Francisco Estuary Regional Monitoring Program for Trace Substances (RMP) or the City of San Jose monitoring program still approach or exceed the previously-applicable federal criteria or water quality objectives in Lower South SF Bay. The Regional Board has now adopted site-specific water quality objectives. As discussed below, it is likely that these new objectives are being attained.

I (a). Sources

The external sources of copper and nickel to Lower South SF Bay include a minor contribution from atmospheric deposition and substantial discharges from tributaries/urban runoff and municipal wastewater. The dischargers responsible for the urban runoff discharges are the Santa Clara Valley Water District, County of Santa Clara, City of Campbell, City of Cupertino, City of Los Altos, Town of Los Altos Hills, Town of Los Gatos, City of Milpitas, City of Monte Sereno, City of Mountain View, City of Palo Alto, City of San Jose, City of Santa Clara, City of Saratoga, and City of Sunnyvale. These cities have joined together to form the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). The municipal wastewater dischargers are the Cities of San Jose and Santa Clara, Sunnyvale, and Palo Alto. Each of these cities owns and operates a wastewater treatment plant (Publicly-Owned Treatment Works or POTW) that discharges into San Francisco Bay South of the Dumbarton Bridge.

On an annual basis, about 1100 kg of copper and 1500 kg nickel enters Lower South SF Bay from POTWs. From tributaries, roughly 3800 kg copper and 6000 kg nickel enters this Bay segment each year. During the dry season (June-November), POTW loading is dominant, and tributary loading is dominant during the wet season (December-May). Substantial amounts of copper (about 1.9 million kg) and nickel (about 50 million kg) already existing in the sediments of Lower South SF Bay can also contribute to water concentrations when the sediments are resuspended by waves, winds, tides, and currents. The metals deposited in the sediments consist of those deposited historically (higher than current levels) and those currently deposited metals. The historical and current external loadings have elevated the total copper and possibly the total nickel concentrations of Lower South SF Bay sediments above what they would be in the absence of anthropogenic sources.

I (b). Stakeholder Involvement

The stakeholder group recognized by the Regional Board to assist in developing watershed-based programs to address both short and long-term water quality issues in Lower South SF Bay is the Santa Clara Basin Watershed Management Initiative (SCBWMI). The SCBWMI, formed in 1996, is a collaborative effort of representatives from business and industrial sectors, professional and trade organizations, civic, environmental, resource conservation and agricultural groups, regional and local public agencies, resource agencies, and the general public. These groups have joined forces to address all sources of pollution that threaten the water bodies draining into the South Bay. A major aim of the SCBWMI is to coordinate existing watershed activities on a basin-wide scale, ensuring that environmental protection efforts are addressed efficiently and cost-effectively. The Regional Board will continue to recognize and rely on the leadership of the SCBWMI to ensure the ongoing success of the WQAS.

A working subgroup of the SCBWMI, the Bay Monitoring and Modeling Subgroup, took the lead to address the water quality issues and to provide the basic strategy and information necessary to address both the water quality technical and related regulatory questions. In 1998, the Copper and Nickel TMDL Work Group (Workgroup) was formed by the SCBWMI to provide guidance for the development of the TMDLs for copper and nickel in Lower South SF Bay. A broad group of stakeholders was represented on the Workgroup including several environmental groups, local wastewater dischargers, local public agencies responsible for the urban runoff program, state and federal regulators, industry and local business representatives, and national organizations such as the Copper Development Association.

II. Overview of the TMDL project for copper and nickel in Lower South SF Bay

In 1996, the State of California included the South San Francisco Bay on the §303(d) impaired water body list as a high priority impaired water body. In 1998, the list was updated and specifically identified copper, nickel, mercury and selenium as the metal pollutants of concern. The listing triggered the Clean Water Act §303(d) mandate for the State of California, specifically the Regional Board, to establish TMDLs for these pollutants of concern. To address NPDES permit issues for its wastewater treatment plant, the City of San Jose and other local municipalities took the lead in providing funding for the development of the copper and nickel TMDLs for Lower South SF Bay, and other Lower South SF Bay communities contributed to related SCBWMI activities.

The TMDL effort focused on:

1. Conducting an Impairment Assessment to determine if ambient concentrations of copper and nickel were negatively impacting the designated beneficial uses of Lower South SF Bay;

2. Developing a range of scientifically defensible water quality objectives for copper and nickel;
3. Developing a conceptual model of copper and nickel cycling to evaluate attainment of the range of objectives; and
4. Characterizing sources and identifying pollution prevention and control actions.

The Workgroup oversaw the preparation and review of several technical reports. These reports provide the basis of the conclusions and recommendations of the Workgroup regarding the effects of ambient concentrations of copper and nickel on the beneficial uses of Lower South SF Bay.

II (a). Impairment Assessment and Site-Specific Objectives

The Impairment Assessment Report was finalized in June 2000 to present new information and to re-evaluate the determination that the beneficial uses of Lower South SF Bay were impaired due to ambient concentrations of copper and nickel. Specifically, the goals of the assessment were to:

- Compile and evaluate data on ambient concentrations and toxicity information for copper and nickel in Lower South SF Bay;

- Identify, evaluate and select indicators of beneficial use impairment. The categories of parameters and criteria considered included toxicity (acute and chronic), biological (biota composition, health, abundance, and physical habitat vs. a reference site), chemical (numeric values), and physical (capacity to support uses);

- Develop endpoints for the selected indicators that can be used to assess the existence of impairment and compare these values to ambient concentrations in Lower South SF Bay. The intent of this assessment was to provide policy makers, regulators, and other stakeholders with the best technical laboratory and ambient information currently available to compare with known threshold impact levels on selected indicators;

- Assess the level of certainty with which it can be shown ambient concentrations of copper and nickel are or are not resulting in beneficial use impairment; and

- Recommend numeric values for site-specific objectives (SSOs) for dissolved copper and nickel in Lower South SF Bay in lieu of TMDL development upon finding the Lower South SF is not impaired due to these metals.

The final results of the impairment assessment indicated that impairment to beneficial uses of Lower South SF Bay due to ambient copper and nickel concentrations is unlikely. There are several lines of evidence to support the finding for each metal, and these are discussed at length in the Impairment Assessment Report. One important factor in the impairment decision was the recognition that the chemical features of Lower South SF Bay reduce the toxicity and bioavailability of copper and nickel. These chemical features include binding of copper and nickel by dissolved organic compounds and the abundance of dissolved metals like manganese and iron that compete with copper and nickel for receptor sites on aquatic organisms.

From the established ranges of acute and chronic values of copper and nickel site-specific objectives developed through the Impairment Assessement Report, the Regional Board selected specific values for copper and nickel that it deemed protective of beneficial uses and incorporated them into Chapter 3 of this Basin Plan. The acute and chronic site-specific water quality objectives in Lower South SF Bay for dissolved copper are 10.8 µg/L and 6.9 µg/L, respectively. The acute and chronic site-specific water quality objectives in Lower South SF Bay for dissolved nickel are 62.4 µg/L and 11.9 µg/L, respectively.

While the conclusions of the Impairment Assessment Report are scientifically sound, like most statements about complex environmental systems, its conclusions on the lack of impairment have some degree of uncertainty. The existence of these uncertainties underscores the need for continued monitoring and studies that are described below. The four primary areas of uncertainty are the toxicity of copper to phytoplankton, copper and nickel cycling in Lower South SF Bay, sediment toxicity, and uncertainties in loading estimates.

III. Implementation Plan

This section discusses the actions that will be taken to maintain the copper and nickel site-specific objectives. The underlying goal of these actions is to ensure that ambient levels do not increase due to increases in loading of copper and nickel to Lower South SF Bay. Except for the specification of metal translators, all actions and monitoring obligations described in this section are already required in the NPDES permits for the three municipal wastewater dischargers and the municipal urban runoff (stormwater) dischargers in Lower South SF Bay. Other non-regulatory, collaborative actions discussed here will be implemented via the SCBWMI and its participants on a voluntary basis.

III (a). Monitoring Program and Triggers

Fundamental to the monitoring program is the concept of a water quality indicator. An indicator is a measurable quantity that is so strongly associated with particular environmental conditions that the value of the measurable quantity can be used to indicate the existence and maintenance of these conditions. The indicators used in the monitoring program to support the site-specific objectives are dissolved copper and nickel concentrations in Lower South SF Bay. The monitoring program described here has been required by the NPDES permits for the three municipal wastewater dischargers since October 2000. (Order No. 00-108). The monitoring program consists of monthly dissolved copper and nickel measurements at the ten stations shown in Table 4-1a. As of the adoption of this WQAS, the municipal wastewater dischargers defined dissolved metal as those metal constituents that pass through a 0.45 µm filter prior to chemical analysis. Any changes to this operational definition of dissolved metal or details of the monitoring program will be addressed through amendments to the NPDES permits

Table 4-1a List of sampling stations that form the monitoring network for copper and nickel in Lower South SF Bay

SBS Site ID	Reference Location	Longitude	Latitude	RMP site ID
SB01	Channel Marker #14	37° 30.782'	122° 8.036'	BA30
SB02	Channel Marker #16	37° 29.595'	122° 5.243'	BA20
SB03	Channel Marker #20	37° 27.437'	122° 3.033'	BA10
SB04	Coyote Creek Railroad Bridge	37° 27.600'	121° 58.540'	C-3-0
SB05	Coyote Creek at Guadalupe River confluence	37° 27.875'	122° 1.406'	NA
SB06	Between Channel Markers #17 & #18	37° 28.390'	122° 4.180'	NA
SB07	Mouth of Mowry Slough	37° 29.499'	122° 3.110'	NA
SB08	Mouth of Newark Slough	37° 30.066'	122° 5.231'	NA
SB09	North of Cooley Landing	37° 28.959'	122° 7.068'	NA
SB10	Old Palo Alto Yacht Club Channel Mouth	37° 28.087'	122° 5.846'	NA
SB11	Standish Dam in Coyote Creek	37° 27.150'	121° 55.501'	BW10
SB12	Alviso Yacht Club Dock	37° 25.574'	121° 58.778'	BW15

The purpose of the monitoring component of the WQAS is to assess ambient conditions compared to the specific trigger levels described below. The ambient data collected through the WQAS monitoring program may be considered along with other ambient monitoring data to determine whether additional controls are necessary.

Trigger Values

The NPDES permits for municipal wastewater and stormwater dischargers contain a series of trigger values and corresponding actions that are required to be taken by the dischargers if the triggers are reached. For copper, an increase in dry season dissolved copper concentration of 0.8 µg/L can be reliably detected despite inherent variability, and this specific increase is used to define the copper trigger levels. The copper Phase I trigger is reached and copper-specific Phase I actions will be conducted if the average dry season dissolved copper concentration at stations SB3, SB4, SB5, SB7, SB8, SB9 increases from 3.2 µg/L (overall dry season mean from indicator stations during the period June 1997 to November 1998) to 4.0 µg/L. The copper Phase II trigger is reached and Phase II actions will be conducted if the dry season mean concentration of the indicator stations increases further to 4.4 µg/L. This 0.4 µg/L change can still be detected with reasonable statistical certainty to justify the more aggressive Phase II actions.

For nickel, an increase in dry season dissolved concentration of 2.0 µg/L can be reliably detected despite inherent variability, and this increase is used to define the trigger levels for nickel. The nickel Phase I trigger is reached and Phase I actions will be conducted if the average dry season dissolved nickel concentration at stations SB3, SB6, SB7, SB8, SB9, SB10 increases from 4.0 µg/L (overall dry season mean from indicator stations during the period June 1997 to November 1998) to 6.0 µg/L. The nickel Phase II trigger is reached and Phase II actions will be conducted if the dry season mean dissolved concentration from the indicator stations increases another 2.0 µg/L to 8.0 µg/L. Note that the copper and nickel Phase I and Phase II triggers are well below the site-specific objectives for these metals and reaching the triggers indicates a negative trend in water quality but not impairment of beneficial uses.

The Executive Officer will review the monitoring program results annually and determine whether the trigger values have been reached. The Executive Officer will report findings to the

Regional Board and will notify interested agencies and interested persons of these findings and will provide them with an opportunity to submit their views and recommendations concerning the findings either in written form or at a public hearing.

If the trigger values for ambient copper and nickel concentrations have not been exceeded, the monitoring program will continue to provide information for the next review period. The Regional Board shall evaluate performance of the monitoring program during the annual review to determine if the necessary information is being provided.

III (b). Baseline Actions

These actions are already being implemented through the NPDES permits and will continue until the Regional Board directs otherwise through the permitting process. These actions include: 1) pollution prevention and control actions by public agencies; 2) actions to conduct or track special studies that address specific technical areas of uncertainty (the toxicity of copper to phytoplankton, copper and nickel cycling in Lower South SF Bay, sediment toxicity, and uncertainties in loading estimates); and 3) planning-type studies to track, evaluate, and/or develop additional indicators and associated triggers (i.e., indicators for growth, development, or increased use or discharge of copper and nickel in the watershed).

Baseline Actions Conducted by Municipal Wastewater Dischargers

Baseline actions applicable to municipal wastewater dischargers are actions associated with implementation of reasonable treatment, source control, and pollution prevention measures to limit discharges of copper and/or nickel.

In the consideration of the site-specific objectives for copper and nickel, the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (SIP) requires that dischargers demonstrate that they are implementing reasonable treatment, source control, and pollution prevention measures for these metals. The Regional Board found that continuation of baseline actions satisfies this requirement as long as the copper and nickel trigger levels are not reached in Lower South SF Bay. Pollution prevention and minimization are a significant part of these dischargers' efforts to limit the discharges of copper and nickel. These dischargers have approved Pretreatment Programs and have established Pollution Prevention Programs under the requirements specified by the Regional Board in their NPDES permits.

These findings and specific baseline actions are already being implemented through the NPDES permits for these dischargers (Order No. 00-108, October 2000). The municipal wastewater dischargers are required by their permits to maintain these baseline actions and review and report to the Regional Board on their implementation on an annual basis. Modifications to the current baseline actions may be considered through the permit process, provided that these dischargers demonstrate to the Regional Board that such modifications are consistent with maintaining reasonable treatment, source control, and pollution prevention measures.

Baseline Actions Conducted by Urban Runoff (Municipal Stormwater) Dischargers

The Urban Runoff Management requirements (see later section titled "Urban Runoff Management") and specific copper and nickel baseline actions have been required by the NPDES permit for these dischargers since March 2001 (Order No. 01-024). These requirements include actions associated with implementation of controls to reduce copper and/or nickel in discharges to the maximum extent practicable, actions associated with prohibiting discharges other than stormwater to storm drain systems and waterways, and actions associated with monitoring to evaluate effectiveness of controls, identify sources of pollutants, and to measure or estimate pollutant concentrations and loads. On an annual basis, these dischargers are required to describe the controls that they are implementing and any additional controls that will be implemented. These dischargers are required to provide to the Regional Board detailed descriptions of activities in each fiscal year in annual workplans and associated evaluations and results in annual reports. Modifications to the current baseline actions may be considered through the NPDES permit, provided that the Dischargers demonstrate to Regional Board that such modifications are consistent with maintaining programs that control copper and nickel discharges to the maximum extent practicable in accordance with the requirements of the Regional Board's Comprehensive Control Program for Urban Runoff Management and the Clean Water Act. As long as Lower South SF Bay ambient concentrations of copper and nickel remain below the established Phase I trigger levels, the Regional Board has determined that the baseline actions applicable to urban runoff (municipal stormwater) dischargers satisfy the copper- and nickel-specific requirements of the Comprehensive Control Program for Urban Runoff Management and federal regulations (40 CFR 122.26).

Baseline Actions Conducted by Santa Clara Basin Watershed Management Initiative

As described above, the SCBWMI is a collaborative, stakeholder-participation forum that seeks integration of regulatory and watershed management actions that affect Lower South SF Bay and its tributaries. In addition to the actions required in the NPDES permits for the three municipal wastewater dischargers and the municipal urban runoff dischargers, there are other non-regulatory, collaborative actions that the SCBWMI and participants have committed to implement. These collaborative actions are described in attachments to the NPDES permit for the SCVURPPP and include: establishing a forum on transportation issues and impervious surfaces and for reviewing the appropriateness of transportation control measures with a view toward reducing traffic congestion; implementing measures to improve classification and assessment of watersheds; establishing an environmental clearinghouse of information related to tracking and disseminating new scientific information related to copper toxicity, loadings, fate and transport, and impairment of aquatic ecosystems; and planning-type studies to track, evaluate, and/or develop additional indicators to use and future potential indicators and triggers (i.e., indicators for growth, development, or increased use or discharge of copper and nickel in the watershed). In addition, the SCBWMI serves as a stakeholder participation forum to track, review, and evaluate the baseline actions required by the NPDES permits.

III (c). Phase I Actions

Phase I actions are already specified in the NPDES permits for municipal wastewater and stormwater dischargers. These actions are implemented when the mean value of selected monitoring parameters exceeds specified Phase I water quality triggers. The exceedance of the Phase I trigger indicates a negative trend in water quality and not impairment. Phase I actions consist of both specific remedial actions and planning for implementation of future actions if the Phase II triggers are exceeded.

If the Phase I copper or nickel triggers are exceeded, the Regional Board will consider execution of Phase I and Baseline actions as satisfying both the SIP requirement that municipal wastewater dischargers are implementing reasonable treatment, source control, and pollution prevention measures for copper and nickel and the Basin Plan requirement that municipal stormwater dischargers are implementing controls to reduce copper and/or nickel in discharges to the maximum extent practicable. Within 90 days after the determination of Phase I trigger exceedance, the Regional Board expects both the municipal wastewater and municipal stormwater dischargers to submit, for Executive Officer concurrence, their proposed Phase I plans with implementation schedules to implement additional measures to limit their relative cause or contribution to the exceedance. This submittal should, at a minimum, include evaluation of the Phase I actions and development of a Phase II plan. If the submittal is not received within 90 days of the determination of Phase I trigger exceedance or is not being implemented in accordance with the dischargers' implementation schedule following the Executive Officer's concurrence, the Regional Board may consider enforcement action to enforce the terms of the dischargers' permits.

III (d). Phase II Actions

Phase II actions are already specified in the NPDES permits for municipal wastewater and stormwater dischargers. Phase II actions are implemented when the mean value of selected monitoring parameters exceeds specified Phase II water quality triggers. Phase II actions are intended to reduce controllable sources further to maintain compliance with the site-specific water quality objectives.

If the Phase II copper or nickel triggers are exceeded, the Regional Board will consider execution of Phase II, Phase I and Baseline actions as satisfying both the SIP requirement that municipal wastewater dischargers are implementing reasonable treatment, source control, and pollution prevention measures for copper and nickel and the Basin Plan and Clean Water Act requirement that municipal stormwater dischargers are implementing controls to reduce copper and/or nickel in discharges to the maximum extent practicable. Within 90 days after the determination of Phase II trigger exceedance, the Regional Board expects the dischargers to submit, for Executive Officer concurrence, the proposed Phase II plans with implementation schedules to implement additional measures to limit their relative cause or contribution to the exceedance. If the submittal is not received within 90 days of the determination of Phase II trigger exceedance or is not being implemented in accordance with the dischargers' implementation schedule upon the Executive Officer's concurrence, the Regional Board may consider enforcement action to enforce the terms of the dischargers' permits.

III(e). Metal Translators Applicable to Lower South SF Bay Municipal Wastewater Dischargers

An important regulatory element of the WQAS is the specification of metal translators applicable to the three Lower South SF Bay municipal wastewater dischargers. When the NPDES permits are re-issued, concentration-based effluent limits for these three facilities will be calculated from the chronic copper and nickel SSOs. Water quality objectives for copper and nickel are expressed as dissolved metal concentrations. Effluent limits for the POTWs are expressed as total metal concentrations and must be calculated according to the procedure outlined in the SIP. Therefore, for metals like copper and nickel, the calculation of the effluent limit requires the use of a ratio of total to dissolved metal called the metal translator.

Analyses of data from 12 monitoring stations in Lower South SF Bay (Dumbarton to sloughs) collected from February 1997 to August 2000 and including dissolved and total copper and nickel, total suspended solids (TSS), and tidal data, showed a strong TSS dependence. The statistical analyses explored relationships between translator values and TSS, tide, site, and season. Linear regression with log-transformed dissolved fraction (translator) and TSS data provided the best regression fit. The best-fit regression line and its 95% confidence intervals provided the basis for translator values for copper and nickel.

USEPA guidance (USEPA Office of Water, June 1996. The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion. EPA 823-B-96-007) states that, when there is a relationship between the translator and TSS, regression equations should be used to develop translator values using representative TSS values the for the site under consideration. There is a fairly wide variation in TSS, and the guidance on translator development suggests using a representative TSS value. In Lower South SF Bay, a median TSS value may not account for the higher translator values and dissolved metal levels that result during high TSS episodes. For this reason, copper and nickel translators computed from 95% confidence interval TSS values were used to develop the POTW effluent limits. A copper translator of 0.53, and a nickel translator of 0.44 resulted from this procedure. Using the 95% confidence interval translator provides an additional measure of beneficial use protection in that effluent limits, expressed at total metal, will be lower using a higher value for metal translators. These translators shall be used to compute copper and nickel effluent limits for POTWs discharging to the Lower South SF Bay when NPDES permits for Lower South SF municipal wastewater dischargers are reissued.

Project Element 4 – page 4-13 under section 'BACKGROUND CONCENTRATIONS'

Discharges to the South Bay south of the Dumbarton Bridge face unique challenges owing to the physical and chemical features of this southern portion of San Francisco Bay. As such, the Regional Board may be willing to consider alternative effluent limits for these discharges. ~~are not obligated to com-ply with the effluent limits contained in Table 4-3 because of their unique situations as described in Chapter 3~~. However, in such cases, the discharger would be ~~they are~~ obligated to perform specific, detailed work identified in the Municipal Facilities section of this chapter that will result in the development of site-specific water quality objectives, effluent limits, and other control measures.

When appropriate, ~~The~~ the Regional Board will adopt schedules for developing site-specific water quality objectives and for possibly revising effluent limits when it considers the requests of the South Bay dischargers for exemptions from the discharge prohibitions for their current locations.

Project Element 5 – after page 4-18 under section 'SOUTH BAY MUNICIPA L DISCHARGERS (SAN JOSE/SANTA CLARA, PALO ALTO, AND SUNNYVALE)'

In 1988, the Regional Board identified the following issues that needed further study in the South Bay. As part of the reissuance of the South Bay NPDES permits, the Regional Board required the three South Bay dischargers to address these issues.

- Identify the sources of metals to the WPCPs;
- Assure the quality of WPCP laboratory measurements;
- Evaluate existing WPCP performance relative to the removal of metals and evaluate the feasibility and cost effectiveness of new processes;
- Initiate laboratory and field investigations relative to establishing site-specific numerical receiving water objectives for copper, nickel, and mercury;
- Monitor conversion of saltwater marshes to freshwater marshes adjacent to the point of discharges;
- Evaluate the City of San Jose and Sunnyvale WPCP sludge lagoons;
- Establish an avian botulism monitoring and control program for the City of Sunnyvale treatment ponds and discharge area in the slough; and
- Evaluate WPCP ammonia removals.

Based on the results of these studies, the Regional Board amended the NPDES permits for the three South Bay dischargers on several occasions.

In 1989, San Francisco Bay south of the Dumbarton Bridge (South Bay) was designated by U.S. EPA as an impaired water body under Section 304(l) of the Clean Water Act due to anthropogenic inputs of seven metals. The three municipal plants and stormwater runoff were designated as sources contributing to the impairment. As of 1994, the wastewater effluents of the three plants routinely exceeded the concentration limit for copper and occasionally exceed the limits for other metals, such as nickel. South Bay monitoring data collected by the dischargers from 1989 to 1992 indicate that U.S. EPA water quality criteria for copper, nickel, and mercury ~~are~~ were regularly violated in the receiving waters south of the Dumbarton Bridge.

~~The Basin Plan prohibits the discharge of wastewater to San Francisco Bay south of the Dumbarton Bridge, as well as prohibiting the f o l l o w i n g:~~

- ~~Discharge without initial dilution of at least 10 to 1;~~
- ~~Discharge into any dead-end slough; and~~
- ~~Discharge of any conservative toxic and deleterious substances above the levels that can be achieved by a program accept-able to the Regional Board.~~

The beneficial uses of San Francisco Bay, South Bay (south of the Dumbarton Bridge) and contiguous water bodies are defined in the to be:

- Water contact recreation
- Non-contact water recreation
- Wildlife habitat
- Preservation of rare and endangered species
- Estuarine habitat
- Fish migration
- Fish spawning (potential use)
- Industrial service supply
- Shellfish harvesting
- Navigation
- Commercial and sport fishing

Contiguous water bodies of the South Bay in the vicinity of the discharge include freshwater and saltwater sloughs such as Artesian Slough, Coyote Slough, Mud Slough and Coyote Creek. Beneficial uses of the sloughs have been established based on the beneficial uses formally identified for the South Bay. However, beneficial uses specific to the sloughs need to be assessed to determine which uses exist or potentially could exist. Until such determination is made, Regional Board policy has been to use the tributary rule to interpret which beneficial uses are currently or potentially supported where beneficial uses have not been specifically designated.

The existing discharge locations for Lower South SF Bay municipal wastewater dischargers are contrary to Basin Plan policy concerning discharge prohibitions (listed in Table 4-1). Exceptions to the first three of these prohibitions are discussed in the later section "Discharge Prohibitions Applicable Throughout the Region".

State Board Order WQ 90-5 (1990) found that a net environmental benefit exception to these prohibitions could not be made for the three South Bay municipal discharges~~dischargers~~. However, the order found that a finding of equivalent protection can be made if water quality-based concentration limits for metals and revised mass loading limits for metals are placed in the dischargers' NPDES permits, if Sunnyvale and San Jose/Santa Clara continue avian botulism control programs, and if San Jose/Santa Clara implements mitigation for loss and degradation of endangered species habitat. Order 90-5 also included provisions that would prevent increases in flows that would adversely impact endangered species habitats.

In an effort to demonstrate net environmental benefit, the three South Bay municipal dischargers participated in a five-year Water Quality Monitoring Study conducted by the South Bay Dischargers Authority. Based on that study, the Regional Board found that water quality enhancement occurs due to localized increase of receiving water dissolved oxygen and the flushing effects of the discharge. These effects enhance beneficial uses of non-contact recreation, estuarine habitat, commercial and sport fishing. A finding of net environmental benefit was denied by the State Board, however, based on the impacts of fresh water flow on salt marsh habitat and the uncertainties of the impacts of nutrient and metals loading on beneficial uses. The conversion of salt marsh to brackish or fresh water marsh threatens the habitat of two endangered species (California clapper rail and salt marsh harvest mouse). State Board Order WQ 90-5 directed the San Jose/Santa Clara treatment plant to mitigate for degradation of endangered species habitat. As of December 2001, the three principal issues of WQ 90-5 have been addressed in the following fashion.

Water-Quality Based Effluent Limits

The Regional Board has amended and reissued permits to the South Bay municipal dischargers to provide equivalent protection. On April 17, 1991, the NPDES permits of the three South Bay Municipal Dischargers were amended to include water quality-based concentration limits and revised mass loading limits for metals, as directed by State Board Order WQ 90-5.

Avian Botulism

Annual avian botulism control program reports are provisions of the Sunnyvale and San Jose/Santa Clara permits. These two dischargers have conducted an avian botulism control program by monitoring Artesian Slough, Guadalupe Slough, Coyote Creek, and Alviso Slough for the presence of avian botulism since 1982. Outbreaks of avian botulism as well as other diseases have been controlled by the prompt removal of sick and dead vertebrates. The discharger also supports the collection of bird and other wildlife data, in conjunction with the avian botulism program, to better understand the potential beneficial and detrimental impacts of the discharge on the associated habitat.

Mitigation for loss of endangered species habitat and prevention of flow increases

On March 6, 1991 the San Jose/Santa Clara treatment plant submitted an "Action Plan", with a request that the Action Plan be accepted by the Regional Board as fulfillment of the State Board requirement for a discharge flow limit. In Resolution 91-152, the Regional Board stated that the Action Plan (revised), dated September 30, 1991, fulfilled the intent of the State Board Order WQ 90-5 requirement to limit flows from the San Jose/Santa Clara Water Pollution Control Plant to a level that will halt any further loss or degradation of endangered species habitat. The Resolution contained a provision requiring a Regional Board hearing to consider adopting a 120 million gallon per day average dry weather effluent flow (MGD ADWEF) discharge limit if delays occur that threatened the timely completion or implementation of reclamation projects, or if ADWEF exceed 120 MGD. By letter dated November 26, 1991, the State Board found Resolution 91-152 to be consistent with Order WQ 90-5.

On September 18, 1996 the Regional Board adopted Resolution 96-137, which accepted the discharger's proposal for wetland loss mitigation as required by Provision 6.1 of Order No. 93-117 and requested State Board concurrence that the proposal fulfilled mitigation requirements contained in WQ 90-5. By letter dated October 10, 1996, the State Board concurred that the proposal satisfied requirements of Order WQ 90-5 pertaining to salt marsh conversion.

In 1996, the ADWEF of 132 MGD triggered the requirement in Resolution 91-152 for the Regional Board to hold a hearing. On December 18, 1996 the Regional Board held a hearing on this issue. It considered three options: 1) amend the NPDES permit to limit flows to 120 MGD ADWEF; 2) direct the discharger to propose an alternative solution by June 1997; and 3) no action. The Regional Board adopted the second option (Order No. 97-111). Also at the December 1996 hearing, the Regional Board directed the discharger to conduct a wetland conversions assessment in 1997.

Responding to the 120 MGD ADWEF flow limit, On May 28, 1997, the San Jose/Santa Clara treatment plant submitted the South Bay Action Plan (SBAP) to the Regional Board. The SBAP proposed both near and long-term solutions to reduce the discharge: 1) two projects to begin in the near term (1997-98), (i.e. public education aimed at water conservation and on-site reuse) 2) A third near term project of wastewater diversion to the Sunnyvale treatment plant is under investigation. 3) Seven long-term projects to be completed between 1997 and 2002: indoor water conservation, two expanded water recycling projects, industrial water recycling, inflow/infiltration reduction, and two environmental enhancement projects. Total costs of these projects were estimated to be $150 million and were expected to reduce effluent flows by up to 60 MGD.

The results of a wetlands conversions assessment were submitted on November 30, 1997. The assessment indicated that there were no significant additional salt marsh conversions between 1996 and 1997 and if data are compared to the baseline period of 1989-1991, an increase of 1.3 acres of salt marsh conversion had occurred. It is the intent of the Regional Board to require appropriate mitigation for any wetland losses due to the discharge. Appropriate mitigation shall be determined after consultation with appropriate resource agencies and other interested parties.

Recent Developments for copper and nickel

Starting in 1998, technical studies were initiated to assess the impairment status of South San Francisco Bay south of the Dumbarton Bridge with respect to copper and nickel and determine appropriate site-specific objectives for dissolved ambient concentrations of these two metals. It was determined that impairment of beneficial uses due to these metals is unlikely and recommended ranges of site-specific objectives were established. The site-specific objectives resulting from this work are given in Table 3-3, and the Water Quality Attainment Strategy to support these objectives is described earlier in this Chapter.

~~On September 30, 1991, the City of San Jose proposed the "Action Plan," which was developed to fulfill the endangered species habitat protection requirement. The Action Plan consists of programs for salt marsh conversion mitigation as well as ambitious water conservation and reclamation projects. The Action Plan was accepted by the Regional Board in Resolution 91-152 in lieu of the 120 MGD flow restriction. However, Resolution 91-152 allows for reconsideration of the flow cap if certain conditions of the Action Plan are not met by the discharger. Provisions of the Action Plan are included in the San Jose/Santa Clara NPDES permit as conditions for an exception to the Basin Plan prohibitions.~~

~~In 1991, water quality-based permit limits were included in the dischargers' NPDES permits. These new limits were based on continuing concern regarding ambient and discharged levels of copper, nickel, mercury, and other metals. Because the new limits were frequently exceeded, the Regional Board also adopted enforcement orders concurrent with the adoption of revised NPDES permits in 1993. The enforcement orders establish schedules and a pollution prevention program to achieve compliance with the permit limits for copper, nickel, and cyanide.~~

~~The pollution prevention programs specified in the enforcement order were developed through negotiations between Clean South Bay (a coalition of environmental groups) and the dischargers. Board staff and industrial representatives also participated in the negotiations. These programs represent a second phase of implementation of pollution prevention by the three dischargers. Since the first phase of programs was begun in early 1989, the dischargers have reduced their combined discharge of copper mass by approximately 25 percent, and no longer violate effluent limits for silver. The second phase of programs was designed to control the sources of copper and nickel to the treatment plants from industry, commercial establishments, residences, and copper corrosion from water supply pipes.~~

~~In the industrial sector, the dischargers will require industrial firms that contribute the majority of copper and nickel to the treatment plants to conduct (or have conducted for them) pollution prevention audits and to identify cost-effective measures for reducing those discharges. Additionally, the enforcement orders require the dischargers to adopt new local discharge limits for commercial and industrial facilities. All three dischargers are also required to continue and expand their existing source control programs in the commercial and residential sectors, which have focused on best management practices and public education. To address contributions of copper from the water supply, the dischargers have worked cooperatively with a steering committee comprised of water distributors, suppliers, and retailers and (1) evaluated alter-native corrosion inhibitors to reduce copper corrosion from pipes, and (2) examined the feasibility of eliminating the use of copper sulfate as an algicide in drinking water reservoirs.~~

~~The negotiations with the largest of the three dischargers, the San Jose/Santa Clara plant (75 percent of the three combined flows), resulted in landmark funding arrangements for pollution prevention. As part of the settlement agreement with Clean South Bay, the City of San Jose will establish a capital fund of $2 million to assist small businesses with their investment in cost-effective pollution prevention measures identified by the required audits. The city will also pay $375,000 to establish a Pollution Prevention Center, which accounts for any violations of copper, nickel, or silver that may have occurred or may occur between April 17, 1991, and October 20, 1998. The Center will function as an information clearinghouse for best avail-able pollution prevention technologies. These measures will facilitate pollution prevention strategies that will benefit both the economy (cost-effective control strategies) and the environment (reduced mass discharge) in the long t e r m .~~

~~The enforcement orders contain compliance schedules for specific mass and concentration limits. The compliance schedules were developed to correspond with the required pollution prevention measures and to provide sufficient time for the measures to be implemented and subsequent reductions in mass and concentration to be realized. As of 1994, effluent data from all three plants continue to show substantial improvements with regard to both mass and concentration of metals discharged. These effluent quality improvements may be related to a combination of successful pollution prevention efforts and innovative experimentation with treatment plant operations. In addition, monitoring results from the 1993 Regional Monitoring Program indicated that ambient water concentrations of mercury and copper in the lower portion of the South Bay did not exceed levels of concern. Water column levels of nickel did exceed the objective at one South Bay station. The Regional Board will continue to assess the long-term trends in ambient levels of metals in this segment of the Bay.~~

Appendix B: POTW Pre-Treatment Program Description

Evolution of South Bay Pretreatment Program
and
Source Control Requirements

Starting in 1988, the San Francisco Regional Water Quality Control Board (RWQCB) adopted a number of specific source control/pretreatment requirements for POTWs in the Lower South San Francisco Bay. Eventually, the RWQCB also adopted a regional Basin Plan amendment based on the South Bay permit requirements and the results of the investigations and efforts of the South Bay POTWs. What follows is a brief review of the requirements that resulted in today's source control/pretreatment programs.

Prior to 1988, the NPDES permits adopted by the RWQCB followed the basic requirements contained in the federal regulations and the State Water Resources Control Board's (SWRCB) source control requirements associated with the Clean Water Grant program. In 1998, the RWQCB adopted the first of many NPDES permits implementing the 1987 Clean Water Act (CWA) amendment and the 1986 amendments to the San Francisco RWQCB Basin Plan. This new breed of permit was aimed at implementing the water quality based permit requirements of the CWA amendments and the Basin Plan requirements. Thus, the permits contained numerous effluent limits for new pollutants of concern, specifically heavy metals.

The 1988 permit[13,14] contained a number of findings and requirements, as summarized below, aimed at the investigation and control of heavy metals.

- "interim controls on heavy metals are needed because of the absence of water quality objectives and effluent limits and because of limited assimilative capacity of South San Francisco Bay."
- The SWRCB issued draft Pollutant Policy Document (10/1998) that included several strategies to control toxic pollutants.
- New effluent limits for 10 heavy metals were included in the NPDES permit as well as the first mass load requirement.
- New requirements to expand the standard EPA Pretreatment Program were required. These requirements specifically called for the identification of waste minimization measures.
- The new requirements also expanded the potential sources that the POTWs must evaluate and control beyond the EPA universe of SIUs to include residential, commercial, other non-SIUs and water supplies.

In 1990, the RWQCB adopted an amendment to the 1988 permits. The amendments specifically point out that "source control, including waste minimization, is a more desirable pollutant reduction technique than structural modification at the discharger's plant." In addition, the amendments required specific source control measures as summarized below, based on the results of the studies conducted consistent with the 1988 permits.

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[13] The POTWs were extremely concerned about the ability of the WPCPs to attain the stringent heavy metal effluent limits and the extremely significant costs to construct, operate and maintain new, and in some cases experimental treatment processes. All three Cities appealed the permits to the SWRCB. That appeal lead to other permit appeals including a law suit brought by the City of Sunnyvale and the City of San Jose against the SWRCB's Inland Surface Water Policy.

[14] Continued pressure was put on RWQCB staff and local City staff by various appeals and law suites filed by CBE.

- Measure process waste flows for all targeted industries;
- Regulate auto repair and photo-processing firms;
- Implement "…more frequent inspections and more aggressive enforcement actions";
- Implement a waste minimization program aimed at nickel, copper and lead targeted at all electroplaters and metal finishers and other potential sources of these metals;
- Conduct public education and outreach was also required;
- Develop a list of all commercial dischargers in the service area and determine sources and potential controls;
- Evaluate the effectiveness of the programs (typically through expanded industrial, commercial and trunk line sampling efforts); and
- New reporting requirements, including the annual report.

In 1991, following the SWRCB's Order WQ 90-5, the RWQCB amended the NPDES permits to include interim water quality based effluent limits, decreases in mass loading limits, and the addition of a chronic toxicity limit. The RWQCB staff acknowledged that "It is extremely unlikely, based on past performance, that any of the three dischargers will comply entirely with the proposed interim concentration limits and the revised mass loading limits" and that "If these limits are adopted by the Board, we are virtually guaranteed that violations will occur…" The staff further noted that "The dischargers are presently involved with a source control program, and non-compliance, if it occurs, should be used to target more vigorous efforts." The new effluent limits and lower mass loading limits continued the pressure on the POTWs to continue investigating source control and waste minimization measures.[15]

In 1993, the RWQCB adopted new permits and a Cease and Desist Order (CDO). The CDO included numerous findings regarding the POTWs expanded Pretreatment Programs inspections of automotive, photo-processing, and other commercial facilities. The CDO also recognized the POTWs efforts to conduct education workshops for industry and commercial facilities. However, the CDO continued to expand the investigation and inspection requirements of the City's Pretreatment Program. Specifically, the CDO required the South Bay POTWs to "evaluate the extent to which facilities subject to BMPs have implemented the BMPs…" In addition to automotive and radiator repair and photo-processing establishments, other commercial establishments that fell within the new requirements included dentists, chiropractors, medical facilities, veterinary, radiology, photo-printing, machine shops, hospitals, laboratories, cooling towers, and dry cleaners.

The 1993 CDO included a nine page attachment directed at expanding source control requirements in the following areas:

- Review all non-residential hook-ups,
- Evaluate waste minimization techniques,
- Conduct new pollution prevention studies (audit facilities)
- Implement early reasonable source control measures,
- Develop new local limits including inspection and enforcement standard operating procedures,
- Require industry to develop waste minimization plans,
- Develop new local permits that implement the waste minimization plans,
- Annually characterize loadings from all sources,
- Expand the education and outreach program,
- Develop a pollution reduction incentive program,
- Continue to require zero discharge from commercial facilities,

[15] Please note that many of the new limits were below analytical detection limits.

- Continue a residential education program to reduce metals loading from consumer products disposed in the sanitary sewer,
- Investigate the loading of specific metals from water supply and corrosion sources,
- Initiate a mercury waste minimization program,
- Coordinate efforts with the urban runoff program,
- Continue to track influent, sludge and effluent loadings and performance, and
- Provide annual evaluations of the budget and staffing needs to accomplish the pretreatment/waste minimization program.

Just prior to the adoption of the 1993 NPDES permit and CDO, the three South Bay POTWs were involved in negotiating and signing a settlement agreement with Clean South Bay, a coalition of environmental groups. The agreement included source control measures to reduce the concentration and mass of metals in the POTW effluent. The agreement addressed industrial, residential, and commercial and corrosion/water supply sources and was the main basis for developing the nine-page attachment to the CDO.

In 1998, the RWQCB issued a new NPDES permit to the three South Bay POTWs. The new permit was developed in cooperation with the Santa Clara Basin Watershed Management Initiative (SCBWMI). The SCBWMI, in which the City is an active participant, is a stakeholder driven process. This effort was a major milestone in achieving development of a permit by a stakeholder group that included environmental, regulatory (federal and state), industrial, local public agencies (including the POTWs) and commercial interests.

The 1998 permit was unanimously approved by the RWQCB and was supported by the WMI and the three South Bay POTWs. The 1998 NPDES permit clearly recognized that while the 1993 permit and CDO were subject to the State Board's court-order remand, that pending issuance of the new permits (i.e., the 1998 permits) the three Cities' committed to the Regional Board to abide by the terms of the 1993 permit and CDO.[16]

The 1998 permit required the three POTWs to continue to implement the "…programs that reduce the impacts of commercial and industrial discharges…" and "…strive to maintain permitted industrial headwork's loading at 1997 levels…" The permit clearly requires a two tiered approach: investigate industrial flow reductions, and address flow and load reductions associated with new industry and expansion on current industry through the previously developed mass audit efforts. Finally, the 1998 permit clearly requires the POTWs to continue to implement the Regional Board approved pretreatment and pollution prevention programs. The Regional Board reiterated the significance of maintaining the current level of pretreatment and pollution prevention efforts in finding 15 of Order No. 00-109.

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[16] Relative to the San Jose/Santa Clara NPDES permit, the 1998 permit recognized the City of San Jose's "Pollution Prevention Strategy for a Clean Bay including proposed Local Limits for Copper, Nickel, and Cyanide."(Finding 45). The Clean Bay Strategy was developed to comply with the 1993 permit and CDO requirements. A summary of the Clean Bay Strategy accomplishments and programs is contained in Finding 46 of the 1998 permit (attachment 1). Finding 48 recognizes that the City is implementing a number of programs as part of the Clean Bay Strategy which include: New Industry Program, Industrial User Academy, Industrial User Newsletter, Outreach programs, Commercial Business BMP development, Point Source and Urban Runoff program integration, Storm Sewer Monitoring, and Industrial Monitoring program.

Appendix C: Description of Model Developed and Applied to Predict Copper and Nickel Concentrations in Lower South San Francisco Bay for Use in Conceptual Model Report and Copper Action Plan

Introduction

As part of the recently completed TMDL study for Copper and Nickel in the Lower South San Francisco Bay, a model was developed to support the Conceptual Model of copper cycling in the Lower South SF Bay (LSSFB). The model was originally applied to predict the fluxes of copper and nickel into and out of the LSSFB so that the relative magnitudes of those fluxes could be compared in order to distinguish the significant fluxes from those of less importance. The results were presented in Figures 2-3 and 2-5 of the conceptual model report. As a consequence of the model being able to predict fluxes, it could also predict dissolved and total copper and nickel concentration changes for specified external loading changes, such as from tributaries or POTW discharges. Subsequently, the model was also used in the reverse sense: For a given concentration increase in the LSSFB, what would be the associated loading increase? These results were used in the Copper and Nickel Action Plans.

While the model algorithms, results, and sensitivity analysis are shown in Appendix B of the Conceptual Model Report, a concise description of the model and its assumptions does not exist in one place. This appendix provides such a description.

Major Assumptions

Model assumptions are important because they help to show under what conditions the model can and cannot be applied. The major assumptions used in the modeling approach are:

- **Zero-dimensional**. This means that the LSSFB is treated as a mixed reactor (commonly called continuously stirred tank reactor or CSTR), where there are no spatial dependencies. The means that the predicted concentrations are reflective of average concentrations throughout the LSSFB, and not of any single location. This assumption appears reasonable because historical comparison of water column copper and nickel concentrations in the LSSFB show very little spatial dependencies.
- **Steady state**. This means that the concentrations predicted are representative of each of the two seasons (dry and wet), and not specific events within those seasons that are of short duration. For example, during winter storms that dump significant amounts of precipitation on the LSSFB watershed and that results in elevated runoff of typically short durations (a few days at most), a depression of water column copper and nickel concentrations are observed. The model cannot predict these transient responses.
- **Hydraulic residence times are assumed to be the same for the dry and wet seasons**. Prior to beginning the TMDL study, Dr. Edward Gross of Stanford University had completed a comprehensive modeling study of the LSSFB and determined the hydraulic residence time for the dry season (20 days). That residence time has been used in this model for the dry season. Since no similar modeling studies had been completed for the wet season, the same residence time was used for the wet season as well. While it is likely the residence time is higher than typical wet season residence times, no better data were available to use in its place.

- **Two alternative sets of background stations can be used for calculations**. The background stations are those stations (or locations) north of the Dumbarton Bridge, which is the boundary of the LSSFB, where the influence of the discharges within the LSSFB are negligible (that is the concentrations at those stations do not depend on the discharges in the LSSFB). These stations were chosen based on the location where the concentration gradient away from the LSSFB appeared to become negligible. While this has scientific credibility, nevertheless, the assumption really cannot be proven. The significance of the assumption influences the calculated flux past the Dumbarton Bridge.

Model Operation

The model was implemented in Excel spreadsheets. Different spreadsheets were designed for copper and nickel and for the dry and wet seasons. Default input data are included in the spreadsheets, but the user can change those data as desired.

Model Algorithms

While the model's algorithms are shown in detail in Appendix B of the Conceptual Model Report, the most important ones are described here. The model's dry season predictions have been used in the action plans, so the dry season algorithms are provided here. These differ somewhat from the wet season algorithms, but are generally quite similar. The following algorithms are used to make predictions:

- **Flux past the Dumbarton Bridge, both total and dissolved fluxes within the water column**. This is based on the differences in the concentrations in the LSSFB and the reference stations multiplied by the volume of the LSSFB, and then divided by the residence time of mass in the LSSFB.
- **Particulate flux, or exchange of Cu/Ni flux with the bed in the LSSFB**. This is calculated from mass balance constraint, by subtracting the known external loading coming into the LSSFB from the flux leaving past the Dumbarton Bridge.
- **Internal cycling flux of copper**. This pertains only to the dissolved phase, and is the difference in the dissolved flux past the Dumbarton Bridge and the known dissolved fluxes entering into the LSSFB.
- **Mass of Cu/Ni in bed above background**: The concentration above background in the bed is multiplied by the mass of the bed (to a depth of 1 meter to get the excess in the top meter).

Post-Processing

The purpose of post-processing is to calculate useful quantities from the results of the model. The post-processing algorithms are:

- **Total suspended solids concentrations that result from the sediment flux from the bed.** Since the copper flux from the bed has been previously calculated by one of the model's algorithms described above, and the copper concentrations on the particles are known from site-specific measurements, the sediment mass flux from the bed is calculated from this information by dividing the copper flux by the copper concentrations on the sediments. These results are used to compare against the actual suspended solids concentrations to ensure the results are reasonable.

- **Concentration contributions by source.** Since the mass emissions by source are known as well as the hydraulic resident times, the concentrations in the LSSFB that result from each source is calculated.

Sensitivity Analysis

A sensitivity analysis was conducted for both copper and nickel for the dry and wet seasons. The purpose of the sensitivity analysis was to determine how much model predictions would change if input data were changed. In the analysis in the Conceptual model report, 11 different input data were perturbed one by one by 50 percent each. Generally the flushing time was a sensitive parameter for each endpoint examined. Also, the background concentration was shown to be important in estimation of the fluxes that leave the LSSFB.

Appendix D: Translator Report

Copper Translator Development for Lower South San Francisco Bay

Data Set: City of San Jose dataset from 12 monitoring stations in South Bay (Dumbarton to sloughs) Feb 1997 to August 2000, includes copper, nickel, TSS, and tide.

Step 1. Regression analysis of data to identify variables of importance.

The first step in analyzing the available data in order to develop translators was to examine the interaction among the various variables and determine which were most important in predicting copper translator values. These variables include site, season, total suspended solids concentration (TSS), and tide.

The dataset was analyzed using the CART 3.6.3 (Classification And Regression Trees) program. CART is a software tool developed by statisticians from Stanford University and University of California at Berkeley that uses decision trees to display how data may be classified or predicted. CART searches for important patterns and relationships in data and displays output in a classifier tree form.

CART analysis produces a tree structure in which at each node a parametric division is made by an inequality. Observations that satisfy the condition are sent to the left node, otherwise they are sent to the right node. When a specific split is chosen that minimizes the classification error, the node is replaced by two daughter nodes. Splitting continues until a stopping rule is satisfied. Revisition of higher nodes occurs if necessary to readjust lower level errors. Based on this procedure an exhaustive list of subtrees is created. The optimal tree is the one that minimizes total classification error. The objective is to find an optimal combination of tree size and error (Eisenberg et al. 1996)

The data were analyzed using translator (ratio of dissolved to total copper) as the response variable and site, season (wet or dry), TSS, and tide as input variables. CART analysis was performed to examine which of the above variables were important predictors of translators. The data did not show a strong relationship between tide and translator values. Season was also not a strong predictor of the translator. Based on CART, site was slightly more important than season or tide. Sites11&12 appeared to be statistically different than the other sites. Site 12 is at the Alviso Yacht Club Dock in Alviso slough. Site 11 is in the sloughs off of Coyote Creek. These sites were dropped from the translator calculations because they did not appear to be representative of conditions in Lower South San Francisco Bay. Note that these sites both had low translator values compared to sites 1-10.

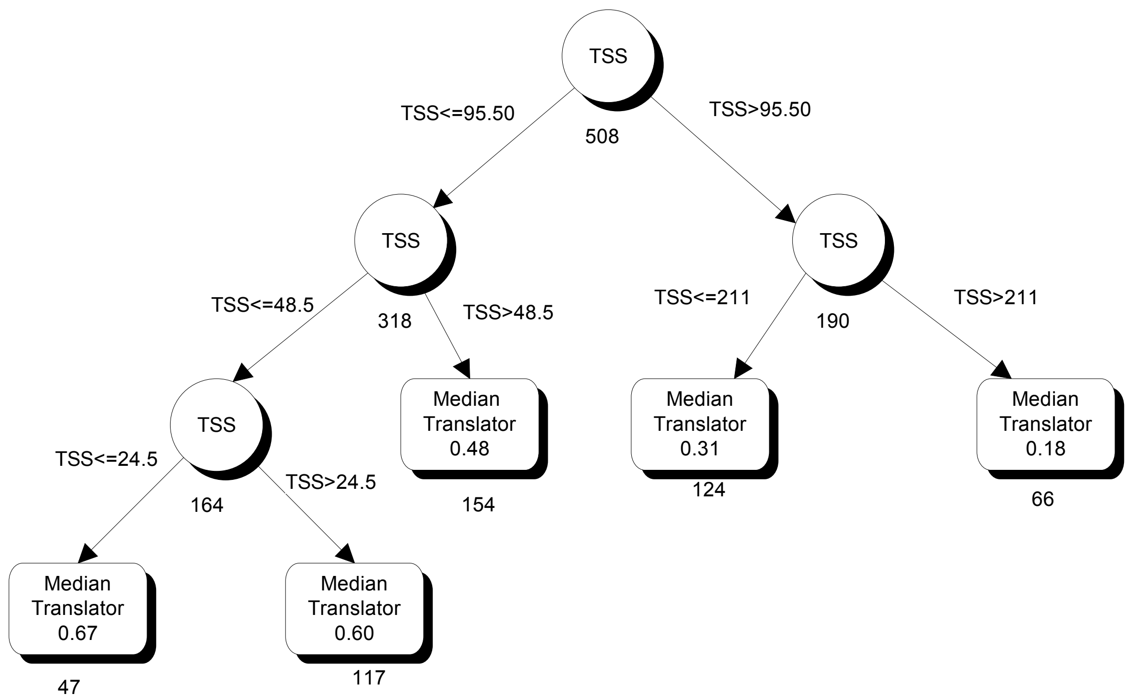
Based on CART analysis, translators do not show strong temporal or seasonal variation. The most important variable in predicting translator is TSS. When analyzed using TSS, tide, season (wet or dry), and all sites except 11 &12 (leaving a dataset of 508 points), CART ranked the relative importance of the variables as follows:

Relative Importance in Predicting Copper Translator

TSS	100.000
Site	27.148
Tide	11.928
Season(w/d)	0.209

The figure below represents the decision tree built by the CART procedure in attempting to identify the important parametric conditions in classifying translator values. The figure can be interpreted as follows: At each node, the text within the circle indicates which variable was used to split the data. The expression between the nodes is the parametric constraint necessary to move down one node; and the number below the circle is the total number of data points satisfying the higher level parametric conditions. The values within the rectangular terminal nodes represent the median value of the translators that meet the conditions required to reach that node.

Copper Translator CART Classification Tree



EPA Metals Translator Guidance[17] and the State Implementation Plan[18] (SIP) require a site-specific translator to account for spatial and seasonal variability. If systematic seasonal variation is demonstrated, seasonal effluent limitations may be justified. Based on analysis of the data, including the CART analysis above, translators in the Lower South Bay do not show strong temporal variation (based on season or tides).

[17] The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion. EPA 823-B-96-007 June 1996

[18] Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. SWRCB 2000

CART analysis also suggests that site is not a good predictor of the translator value (once sites 11 and 12 are removed). TSS is a much better predictor of translator value than site. The relationship between TSS and site was explored using CART to determine whether TSS shows a strong spatial variation. CART analysis suggests that site is not a good predictor of TSS.

Based on this analysis, data from sites 1 through 10 will be used together to determine the relationship between TSS and translator.

Step 2. Determination TSS-Translator relationship.
EPA guidance states that if the translator is found to be dependent on TSS, regression equations relating the fraction dissolved (translator) to TSS should be developed. Various regressions were performed to develop an appropriate transformation. Linear regression with log TSS and log Translator (including data from all sites except 11&12) provided the best fit, with an r^2 value of 0.715. The following relationship was derived:

$$\log \text{Translator} = 0.514 - 0.482 \log \text{TSS}$$

EPA guidance states that the regression equation should be used to develop translator values by inputting representative TSS values for the site under consideration.

95% Confidence Intervals of Linear Regression:

Upper Bound:

$$\log \text{Translator} = 0.570 - 0.454 \log \text{TSS}$$

Lower Bound

$$\log \text{Translator} = 0.458 - 0.511 \log \text{TSS}$$

Step 3 Further analyses of TSS and translator data
After developing the regression equation above, the data was further analyzed to examine the relationship between TSS, sites, and translators. The median value of the copper translators based purely on a ratio of dissolved to total (as opposed to translators derived through the regression equation) is 0.45. Using median TSS and the regression equation yields a copper translator value of 0.42. For reference, the translator value resulting from using the 25th percentile TSS value is 0.56. The translators that result from using the upper and lower bounds regression equations with the median TSS value of 72 are 0.53 and 0.32, respectively.

Site	All(exc11&12)	1	2	3	4	5	6	7	8	9	10	11	12
Translator													
median	**0.45**	0.58	0.50	0.34	0.29	0.32	0.48	0.36	0.41	0.53	0.53	0.33	0.23
stdev	0.20	0.20	0.22	0.22	0.18	0.19	0.23	0.21	0.17	0.19	0.24	0.17	0.15
95%ile	0.78	0.81	0.72	0.70	0.62	0.62	0.79	0.67	0.65	0.87	0.87	0.61	0.49
25%ile	0.30	0.50	0.37	0.15	0.19	0.15	0.31	0.21	0.28	0.37	0.35	0.25	0.16
TSS													
median	**72**	32	62	129	110	120	71	120	93	49	49	51	89
stdev	242	23	68	507	115	345	107	148	81	47	296	130	154
95%ile	465	79	164	1320	380	1184	180	482	258	138	644	147	474
25%ile	39	23	45	56	69	64	39	53	59	33	33	35	63

Translator based on regression equation

	median TSS	Translator
All (not 11&12)	72	0.42
1	32	0.61
2	62	0.45
3	129	0.31
4	110	0.34
5	120	0.32
6	71	0.42
7	120	0.32
8	93	0.37
9	49	0.50
10	49	0.50
11	51	0.49
12	89	0.38

Step 4 Recommendations
Based on analysis of biweekly data from 12 sites in the Lower South SF Bay, spatial and temporal variation are not significant for translators. The recommended copper translator is 0.53, calculated from the upper bound of the linear regression equation based on data from ten stations with a TSS value of 72.

Nickel Translator Development for Lower South San Francisco Bay

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Data Set: CSJ dataset from 12 monitoring stations in South Bay (Dumbarton to sloughs) Feb 1997 to August 2000, includes copper, nickel, TSS, and tide.

Procedure: The methodology employed to develop a copper translator was also used for nickel.

Step 1. Regression analysis of data to identify variables of importance. CART was used to determine the important variables in predicting translator values for nickel. Similar to what was found for copper, TSS was by far the best predictor of translator value. Analysis suggested that sites 11&12 were not representative of conditions in the Lower South Bay and were dropped from the data used to determine the nickel translator. Site, tide, and season were not strong predictors of nickel translator value.

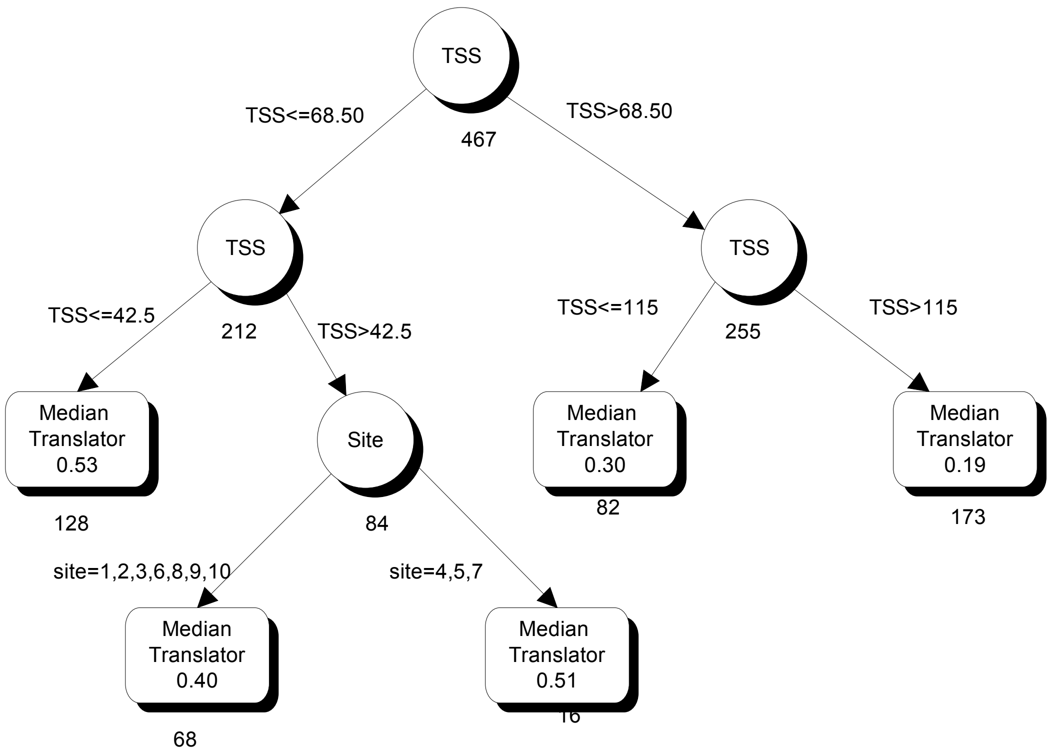
When analyzed using TSS, season (wet or dry), and all sites except 11 &12 (leaving a dataset of 467 points), CART ranked the relative importance of the variables as follows:

Relative Importance in Predicting Nickel Translator

TSS	100.000
Site	7.194
Season(w/d)	4.673

The figure below represents the decision tree built by the CART procedure in attempting to identify the important parametric conditions in classifying translator values. The figure can be interpreted as follows: At each node, the text within the circle indicates which variable was used to split the data. The expression between the nodes is the parametric constraint necessary to move down one node; and the number below the circle is the total number of data points satisfying the higher level parametric conditions. The values within the rectangular terminal nodes represent the median value of the translators that meet the conditions required to reach that node.

Nickel Translator CART Classification Tree



EPA Metals Translator Guidance[19] and the State Implementation Plan[20] (SIP) require a site-specific translator to account for spatial and seasonal variability. If systematic seasonal variation is demonstrated, seasonal effluent limitations may be justified. Based on analysis of the data, including the CART analysis above, translators in the Lower South Bay do not show strong temporal variation.

Based on this analysis, data from sites 1 through 10 will be used together to determine the relationship between TSS and translator.

Step 2. Determination TSS-Translator relationship.
EPA guidance states that if the translator is found to be dependent on TSS, regression equations relating the fraction dissolved (translator) to TSS should be developed. Various regressions were performed to develop an appropriate transformation. Linear regression with log TSS and log Translator (including data from all sites except 11&12) provided the best fit, with an r^2 value of 0.715. The following relationship was derived:

[19] The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion. EPA 823-B-96-007 June 1996
[20] Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. SWRCB 2000

$$\log \text{Translator} = 0.439 - 0.500 \log \text{TSS}$$

EPA guidance states that the regression equation should be used to develop translator values by inputting representative TSS values for the site under consideration.

95% Confidence Intervals of Linear Regression:

Upper Bound:

$$\log \text{Translator} = 0.508 - 0.465 \log \text{TSS}$$

Lower Bound

$$\log \text{Translator} = 0.369 - 0.536 \log \text{TSS}$$

Step 3 Further analyses of TSS and translator data

After developing the regression equation above, the data was further analyzed to examine the relationship between TSS, sites, and translators. The median value of the nickel translators based purely on a ratio of dissolved to total (as opposed to translators derived through the regression equation) is 0.33. Using median TSS and the regression equation yields a copper translator value of 0.32. For reference, the translator value resulting from using the 25th percentile TSS value is 0.44. The translators that result from using the upper and lower bounds regression equations with the median TSS value of 72 are 0.44 and 0.24, respectively.

Step 4 Recommendations

Based on analysis of biweekly data from 12 sites in the Lower South Bay, spatial and temporal variation are not significant for translators. The recommended nickel translator is 0.44, calculated from the upper bound of the linear regression equation based on data from ten stations with a TSS value of 72.

Regression Analysis

	Coefficients		Translator resulting from specified		
			25%ile	median	95%ile
	Slope	Const	39	72	465
Lower bound*	-0.536	0.369	0.33	0.24	0.09
Regression	-0.5	0.439	0.44	**0.32**	0.13
Upper bound*	-0.465	0.508	0.59	0.44	0.19

*bounds of 95% confidence interval of regression line

Appendix E: Tables of all Baseline, Phase I, and Phase II Actions of the Implementation Plan

The columns of the following tables of actions are defined as follows:

Description of the Action to be Performed by the Lead Party	**This is a brief description of the action to be implemented.**
Lead Party	This is a list of the parties responsible for carrying out the action. See below for more information on various parties that are named as lead party. Where the lead party is a permitted entity (POTWs or SCVURPPP and Co-Permittees), the RWQCB can compel the actions through the permits. Where the lead party is not under a permit, the RWQCB cannot compel the action through a permit.
Implementation Time Frame	This column only applies to the baseline actions. This is an indication as to whether the action should be ongoing or is satisfied by the submittal of a single report or series of reports.
Implementation Mechanism	This column provides information on how the Regional Board will track the status of the action. This is often a report that is submitted by the Lead Party.

Term or Acronym	Definition
Annual Report (Urban Runoff Program)	Report submitted by the Urban Runoff Program each September. This report details the actions, including status, that took place the previous year. Status of all baseline actions should be reported either in the Annual Report or Annual Workplan. There should be sufficient detail in the description and status of actions to assess permit compliance.
Annual SMR (POTWs)	Annual Self-Monitoring Report submitted each year to provide data for compliance checking
Annual Workplan (Urban Runoff Program)	Report submitted by the Urban Runoff Program each March. This report details the actions that will be taken in the year following.
BASMAA	Bay Area Stormwater Management Agencies Association which includes the SCVURPPP and the other urban runoff programs in the San Francisco Bay region
BMP	Best Management Practice
Brake Pad Partnership (BPP)	A diverse stakeholder group addressing the connection of brake pad wear debris and environmental problems
CAP/NAP	Copper Action Plan/ Nickel Action Plan, June 2000
CMR	Conceptual Model Report, December 1999
Continuous Improvement Process	Continuous Improvement activities identified by the Urban Runoff Permit Re-issuance Work Group as part of the SCVURPPP permit re-issuance are contained in Table 3 “Urban Runoff Permit Re-issuance Work Group --Box 3: Summary of Continuous Improvement Items” (dated June 23, 2000).
Cu-L1, Cu-L2 complexes	Strong (L1) and weak (L2) copper complexes formed in the aquatic environment

CWC	California Water Code (Porter-Cologne)
IAR	Impairment Assessment Report by TetraTech, June 2000
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly-Owned Treatment Works. These are wastewater treatment plants.
RMP	Regional Monitoring Program for Trace Substances
SCBWMI (Core Group)	Santa Clara Basin Watershed Management Initiative (Core Group is the lead stakeholder body for this initiative, there are subgroups as well)
SCVURPPP & Co-permittees	Santa Clara Valley Urban Runoff Pollution Prevention Program. The Co-Permittees include the SCVWD, Santa Clara County and the 13 cities in the Santa Clara Valley
SCVWD	Santa Clara Valley Water District
SEIDP	The Stormwater Environmental Indicators Demonstration Project (SEIDP) is part of USEPA's Environmental Indicators/Measures of success project. The SEIDP is the third phase of EPA's program that focuses on local demonstration projects and the testing of indicators in the Walsh Ave. catchment, water quality indicators, programmatic indicators, social indicators, and site indicators are being evaluated to gauge Program implementation. Twenty different indicators are under review.
SFEI	San Francisco Estuary Institute
SWQTF	Storm Water Quality Task Force
URMP	Urban Runoff Management Plan, describes goals, program elements, including monitoring and watershed management measures, and model performance standards
USGS	United States Geological Survey
VMT	Vehicle Miles Traveled

Appendix E
Baseline Copper Control Actions

Baseline Number	Description	Lead Party	Implementation Mechanism
CB-1	*Measures to reduce copper discharges from vehicle washing operations.* These shall include outreach and education activities targeted towards residential car washing, washing of vehicles at commercial and industrial facilities; and vehicle washing by mobile cleaners; implementation of BMPs by mobile cleaners; and inspections or other mechanisms to evaluate effectiveness of these measures.	SCVURPPP & Co-permittees	Urban Runoff and Industrial Stormwater Permits Reporting conducted as part of SCVURPPP and Co-permittees Annual Reports
CB-3	*Measures to control copper in discharges of stormwater from targeted industrial sources.* These shall include identification and implementation of appropriate and cost-effective controls. The targeted industries include older printed circuit board manufacturers and metal plating facilities using copper. Clarify linkage with POTW Pretreatment Programs	SCVURPPP & Co-permittees & industry Possibly POTW permits (clarify need by March 2001 as part of SCVURPPP Work Plan)	Urban Runoff and Industrial Storm Water Permits Reporting conducted as part of SCVURPPP and Co-permittees Annual Report. Future Work Plans will contain description of additional tasks. Develop approach to implement Area-Wide as part of March 2001 Work Plan.
CB-10	*Measures associated with utilizing the Sediment Characteristics and Contamination Environmental Indicator.* These shall include utilizing results of SEIDP Indicator #5 (Sediment Characteristics and Contamination) to investigate development of an environmental indicator and investigate the linkage with SFEI sources and loading work effort.	SCVURPPP & Co-permittees	SCVURPPP & Co-permittees as part of Permit Annual Work Plan and Annual Report
CB-11	*Measures to improve street sweeping controls and storm water system operation and maintenance controls to reduce copper in stormwater discharges.* These shall include consideration of need for improvements to existing street sweeping controls and storm water system operation and maintenance controls and standard operating procedures for disposal of collected materials.	SCVURPPP	Consider need for improvements as part of SCVURPPP Continuous Improvement Process
CB-12	*Measures to control copper discharges from pools and spas.* These shall include maintaining existing education and outreach programs for pools and spas.	SCVURPPP & Co-permittees	SCVURPPP & Co-permittees implementation via URMP Performance Standards and modification via Continuous Improvement Process

Appendix E
Baseline Copper Control Actions

Baseline Number	Description	Lead Party	Implementation Mechanism
CB-15	*Measures to evaluate effectiveness of Performance Standards and identify cost-effective modifications to reduce discharges of copper.* These shall include utilizing results of SEIDP to evaluate effectiveness of related SCVURPPP Performance Standards and identify cost-effective modifications	SCVURPPP & Co-permittees	SCVURPPP & Co-permittees Continuous Improvement Process
CB-13	*Track POTW Pretreatment Program efforts and POTW Loadings*	POTWs	POTW NPDES Permits (reporting part of Annual SMR and Pretreatment Program reports)
CB-14	*Track and encourage water recycling efforts*	POTWs	Reporting through POTWs Annual Water Recycling report and/ or Annual SMR
CB-19	*Continue to promote industrial water use and reuse efficiency.* These programs may include workshops, outreach, incentives, or audits.	POTWs	POTW permits
CB-2	*Measures to track copper sulphate use by water suppliers.* The District shall continue to track and report use of copper sulphate by water suppliers in the Santa Clara Valley (includes State & Federal Water Project).	SCVWD	Urban Runoff Permit Report tracking results as part of SCVWD Co-permittee Annual Report
CB-9	*Continue current efforts and track corrosion control opportunities:* •Continue educational outreach, within the City of Palo Alto, to plumbers and designers to reduce corrosion of copper pipes via better design and installation •Track developments in (a) alternatives to copper piping (b) corrosion inhibitors, and (c) other methods of reducing copper corrosion	City of Palo Alto Environmental Compliance Unit (track and report developments to the SCBWMI)	POTW permit Reporting conducted as part of annual Pretreatment Program report.

Appendix E
Baseline Copper Control Actions

Baseline Number	Description	Lead Party	Implementation Mechanism
CB-4	*Measures to quantify copper control/pollution prevention measures and source loadings*. These shall include investigating and/or tracking agreed upon quantification studies concerning copper in vehicle brake pads and field investigations to monitor long-term trends to determine the possible linkage between copper from brake pads and copper concentrations in water.	SCBWMI/SCVURPPP (lead party may change depending on quantification study identified)	SCVURPPP Continuous Improvement Process and Annual Work Plans and/or SCBWMI Core Group / Subgroup work plan task
	1-Provide appropriate level of local support for agreed upon quantification studies		SCVURPPP Work Plan (include as part of Multi-Year Receiving Waters Monitoring Plan)
	2 Investigate and/or track quantification studies for a wide range of existing copper control/pollution prevention measures and sources loadings		
	3-Collect data and prepare annual reports on the following potential indicators • Copper content in new auto brake pads • Total population in basin • Auto/truck vehicle traveled in basin • Copper sulfate (e.g. algaecide, pesticide, industrial; chemicals) sales in basin (aggregate basis-scaled to basin level estimate) • Copper content in macoma tissue at San Point (Palo Alto) • Reproductivity index for macoma at Sand Point • Benthic community assemblage at Sand Point	City of Palo Alto	POTW permit amendment
	4-Prepare issue paper on feasibility of potential field investigation to monitor long-term trends between copper from brakepads and concentration in water.	RWQCB/SCVURPPP	
CB-6	*Measures to reduce traffic congestion* Review appropriateness of transportation control measures, prioritize reasonable measures and identify potential efforts for further development as part of Phase I and implementation as part of Phase II	SCBWMI (SCVURPPP take lead on preparing short-term issue paper as part of LUS (land use subcommittee of WMI) that begins to investigate the role of storm water management agencies in regional congestion management planning and	CORE GROUP short-term issues (SCVURPPP to consider possible early measures as part of developing FY 01-02 Work Plan)

Appendix E
Baseline Copper Control Actions

Baseline Number	Description	Lead Party	Implementation Mechanism
		implementation)	
CB-7	*Measures to reduce traffic congestion* Establish transportation/impervious surface "forum" • Consider results of VMT and imperviousness load estimates and control effectiveness evaluation; identify potential control efforts for further development as part of Phase I and implementation as part of Phase II	SCBWMI (incorporate as part of short-term issue paper on CB-6)	CORE GROUP short-term issue
CB-8	*Measures to classify and assess watersheds.* These shall include assisting the SCBWMI in its continuing efforts to implement watershed classification and assessment efforts and to improve institutional arrangements for watershed protection. These efforts shall include: • Ensuring that watershed protection is considered in all applicable elements of Dischargers' General Plans land use, circulation, open space, transportation, and conservation, and consistency requirements; and seek appropriate changes in State General Plan Guidelines; and • Ensuring that watershed protection is considered in the California Environmental Quality Act process. • Continue to implement watershed classification and assessment efforts of SCBWMI.	SCBWMI (with assistance from the SCVURPPP and Co-permittees)	SCVURPPP Continuous Improvement Process and Annual Work Plans and/or SCBWMI Core Group / Subgroup work plan task
CB-16	*Measures to establish an environmental clearinghouse.* These shall include assisting the SCBWMI in establishing an information clearinghouse and tracking and disseminating new scientific research on copper toxicity, loadings, fate and transport, and impairment of aquatic ecosystems	SCBWMI – CORE Group (assistance via SCVURPPP)	Implement through watershed measures element of SCVURPPP Permit and SCBWMI Long-term Data Management Plan (connected with resources for CB-5.3) Begin reporting as part of SCVURPPP Annual Report for FY 00-01
CB-5	*Measures to support Brake Pad Partnership activities.* These shall include providing appropriate level of local support for agreed upon BPP activities. 1-Review/assess/provide input on Brake Manufacturing Council (BMC)/BPP brakepad wear debris research & brakepad content data.	1-SCVURPPP currently tracking with funds designated in FY 00-01 Work Plans	1-SCVURPPP Continuous Improvement Process and Annual Work Plans (will utilize conference

Appendix E
Baseline Copper Control Actions

Baseline Number	Description	Lead Party	Implementation Mechanism
	2-Ensure that other local state and federal players are involved appropriate on brakepads issue as it is a widespread urban concern. 3-Assist in making research data that are in the public domain accessible	2-BASMAA & SWQTF involvement on BPP may be needed as a Task of Regional Benefit 3- SCBWMI data management system	results to lay out potential future direction/needs) BASMAA Task of Regional Benefit (TRB) (SCVURPPP recommend BASMAA consider funding TRB to support Regional involvement with BPP including investigation of fate and transport) 2- BASMAA Task of Regional Benefit (SCVURPPP recommend BASMAA & SWQTF consider funding to support State and Regional involvement with BPP including investigation of fate and transport) 3-SCVURPPP via data management efforts and in conjunction with WMI efforts incorporate BPP and other related and readily available into metadata database
CB-17	*Measures to reduce uncertainty associated with the Lower South San Francisco Bay Impairment Decision.* These shall include assisting the SCBWMI in tracking and encouraging the investigation of several important topics that influence uncertainty with Lower South San Francisco Bay Impairment Decision • Phytoplankton toxicity and movement (Impairment Assessment Report Section 5.3.1) • Sediment cycling • Loading uncertainty Encourage incorporation of appropriate bioassessment tools into ongoing monitoring programs to track presence of copper-sensitive taxa in Lower South SF Bay.	SCBWMI – Core Group (assistance via POTW and SCVURPPP and Co-permittees)	Track and encourage RMP, NOAA, USGS, etc.

Appendix E
Baseline Copper Control Actions

Baseline Number	Description	Lead Party	Implementation Mechanism
CB-18	*Measures to investigate important factors that influence copper fate and transport.* These shall include assisting the SCBWMI in tracking and encouraging the investigation of important factors that influence copper and fate and transport. • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations • Investigate algal uptake/toxicity with competing metals	SCBWMI – Core Group (assistance via POTW and SCVURPPP and Co-permittees)	Track and encourage RMP, NOAA, USGS, etc.
CB-20	*Measures to revise the Copper Conceptual Model Report findings.* These shall include assisting the SCBWMI and the POTWs that discharge to Lower South SF Bay in revising the Copper Conceptual Model Report uncertainty table based on newly-available information and producing a status report. In particular, these activities will include revising the conceptual model uncertainty table based on newly-available information as part of the Dischargers' and POTWs' next NPDES permit applications.	SCBWMI (with assistance from POTWs and SCVURPPP & Co-permittees)	CORE GROUP short-term issue Update as part of NPDES Permit application process Possible linkage and assistance from North Bay effort as well as RMP and RWQCB TMDL efforts
CB-21	*Measures to discourage architectural use of copper.* These shall include assistance to the SCBWMI in the following areas: 1-SCVURPPP & Co-permittees evaluate feasibility of discouraging architectural use of copper & explore feasibility of related policy 2-Promote Green Building principles and identify measures to investigate as part of Phase I	Palo Alto (Lead) SCBWMI (with assistance from the SCVURPPP and Co-permittees)	CORE GROUP short-term issues (use SCVURPPP Continuous Improvement Process for agreed upon assistance) SCVURPPP & Co-permittees Continuous Improvement Process

Appendix E (continued)
Phase I Copper Control Actions

Phase I Number	Description	Lead Party	Implementation Mechanism
CI-5	*Evaluate street sweeping and other design, operation and maintenance practices to identify potential improvements.* Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	SCVURPPP & Co-permittees	SCVURPPP & Co-permittee Continuous Improvement Process
CI-6	*Follow-up on relevance of copper in diesel exhaust*	SCVURPPP & Co-permittees	SCVURPPP & Co-permittee Continuous Improvement Process
CI-7	*Develop Phase II Implementation Plan for POTW expansion of water Recycling*	POTWs	POTW permits
CI-10	*Evaluate results of tracking industrial virtual closed- loop wastewater efficiency measures and develop potential actions.* Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	POTWs	POTW permits
CI-11	*Develop Phase II Implementation Plan for POTW process optimization*	POTWs	POTW permits
CI-4	*Prepare and implement a Phase I plan for improved corrosion control based on evaluation of results of Baseline measures.*	POTWs/ SCVWD and other suppliers	POTW permits and other CWC regulatory Mechanisms
CI-9	*Evaluate and investigate important Factors that Influence Copper Fate* (Potential Reduction in Uncertainty is Moderate to High)[1] • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations Investigate algal uptake/toxicity with competing metals	SCBWMI – Core Group (Assistance via POTW and / SCVURPPP and Co-permittees)	Encourage and identify resources (coordinate with other efforts/investigations such as those of SF Estuary Regional Monitoring Program, NOAA, USGS, etc)
CI-8	*Evaluate and investigate important topics that influence uncertainty with Lower South SF Bay Impairment Decision* • Phytoplankton toxicity and movement (IAR Section 5.3.1) • Sediment cycling • Loading uncertainty	SCBWMI – Core Group (Assistance via POTW and / SCVURPPP and Co-permittees)	Encourage and identify resources (coordinate with other efforts/investigations such as those of RMP, NOAA, USGS, etc)
CI-12	*Develop a Phase II Plan including a re-evaluation of Phase I actions*	RWQCB – convene powers that be	CWC regulatory mechanisms

Appendix E (continued)
Phase I Copper Control Actions

Phase I Number	Description	Lead Party	Implementation Mechanism
CI-1	*Update findings and recommendations of BPP efforts and implement agreed upon Phase I measures and develop Phase II Work Plan*	RWQCB – convene powers that be	NPDES permits and other CWC regulatory mechanisms
CI-2	*Update findings and recommendations of transportation/ impervious surface "forum" and implement agreed upon Phase I measures and develop Phase II Work Plan*	RWQCB – convene powers that be	NPDES permits and other CWC regulatory mechanisms
CI-3	*Update and re- evaluate source identification and prioritize sources based on effectiveness evaluation of future potential control actions.* Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	RWQCB – convene powers that be	NPDES permits and other CWC regulatory mechanisms

Appendix E (continued)
Phase II Copper Control Actions

Phase II Number	Description	Lead Party	Implementation Mechanism
CII-4	*Discourage use of copper-based pesticides*	SCVURPPP & Co-permittees	SCVURPPP & Co-permittee Continuous Improvement Process
CII-1	*Reconsider usefulness of managing storm water through POTWs*	POTWs (with assistance from SCVURPPP and Co-permittees)	CWC regulatory mechanisms
CII-3	*Implement plan for additional corrosion control measures*	POTWs/ SCVWD and other suppliers	POTW permits and other CWC regulatory mechanisms
CII-5	*Implement control actions identified for copper in diesel exhaust*	RWQCB – convene powers that be	Possible Regulatory and Legislative mechanisms
CII-6	*Implement Phase II POTW process optimization measures*	RWQCB – convene powers that be	POTW permits
CII-7	*Implement agreed upon Phase II expansion of water recycling programs*	RWQCB – convene powers that be	POTW permits

Appendix E (continued)
Phase II Copper Control Actions

Phase II Number	Description	Lead Party	Implementation Mechanism
CII-8	*Re-evaluate Phase II Plan (developed as part of I-2) and finalize for implementation*	RWQCB – convene powers that be	CWC regulatory mechanisms
CII-2	*Implement agreed upon Phase II surface control measures (transportation/impervious/-brakepad)*	RWQCB – convene powers that be	CWC regulatory mechanisms and possibly other regulatory agency mechanisms

Appendix E (continued)
Baseline Nickel Control Actions

Baseline Number	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism
NB-1	Co-permittees and SCVURPPP continue to implement Performance Standards Continue to implement URMP (Metals Control Measures Plan): EROSION-1 *Implement performance standards for construction inspection.* EROSION-2 *Participate in development of region-wide training and certification program for construction site inspectors.*	SCVURPPP & Co-permittees	Ongoing/Action Implemented Every Year Workshop for municipal staff on post-construction controls for new development and re-development. Support RWQCB's Annual Workshops for contractors and municipal staff on construction site management and erosion/sediment controls.	Urban Runoff Permit Reporting conducted as part of SCVURPPP and Co-permittees Annual Reports Improve Performance Standards and reporting via SCVURPPP Continuous Improvement process
NB-2	Utilize results of SEIDP Indicator #5 (Sediment Characteristics and Contamination) to investigate development of an environmental indicator and investigate the linkage with SFEI sources and loading work effort.	SCVURPPP & Co-permittees	SCVURPPP FY 01-02 Work Plan and multi-year receiving water monitoring plan	SCVURPPP & Co-permittees as part of Permit Annual Work Plan and Annual Report
NB-5	Utilize results of SEIDP to evaluate effectiveness of related SCVURPPP Performance Standards and identify cost-effective modifications	SCVURPPP & Co-permittees	SCVURPPP FY 01-02 Work Plan and multi-year receiving water monitoring plan	SCVURPPP & Co-permittees Continuous Improvement Process

Appendix E (continued)
Baseline Nickel Control Actions

Baseline Number	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism
NB-3	*Track POTW Pretreatment Program efforts and POTW loadings*	POTWs	Ongoing / Action implemented every year	POTW NPDES Permits (reporting part of Annual SMR and Pretreatment Program reports)
NB-4	*Track and encourage water recycling efforts*	POTWs	Ongoing / Action implemented every year	Reporting through POTWs Annual Water Recycling report and/ or Annual SMR
NB-6	*Continue to promote industrial water use and reuse efficiency*. These programs may include workshops, outreach, incentives, or audits.	POTWs	Ongoing / Action implemented every year	POTW permits
NB-7	*Track and encourage a watershed model linked to a process oriented Bay model*	POTWs/SCVURPPP	Ongoing/Action Implemented Every Year	POTW & SCVURPPP Permits

Appendix E (continued)
Phase I Nickel Control Actions

Phase I Number	Description	Lead Party	Implementation Mechanism
NI-1	*Prepare issue paper on the feasibility and cost of alternative reservoir management options*	SCVURPPP & Co-permittees	Urban Runoff Permit
NI-2	*Prepare issue paper on the feasibility and cost of additional rural trail/road controls* (follow-up to NB-1 (CB-9) and alternative grazing management options)	SCVURPPP & Co-permittees	Urban Runoff Permit
(Same as CI-7)	*Develop Phase II Implementation Plan for POTW expansion of water recycling*	POTW Permits	RWQCB – convene powers that be
(Same as CI-10)	*Evaluate results of tracking industrial virtual closed- loop wastewater efficiency measures and develop potential actions*	POTW Permits	RWQCB – convene powers that be
(Same as CI-11)	*Develop Phase II Implementation Plan for POTW process optimization*	POTW Permits	RWQCB – convene powers that be
(Same as CI-12)	*Develop a Phase II Plan including a re-evaluation of Phase I actions and implement if Phase II triggers are exceeded*	RWQCB – convene powers that be	CWC regulatory mechanisms

Appendix E (continued)
Phase I Nickel Control Actions

Phase I Number	Description	Lead Party	Implementation Mechanism
(Same as CI-3)	*Update and re-evaluate source identification for nickel and prioritize sources based on effectiveness evaluation of future potential control actions*	RWQCB – convene powers that be	NPDES permits and other CWC regulatory mechanisms
NI-3	*Develop a Phase I Plan including an evaluation of the results Baseline actions*	RWQCB – convene powers that be	CWC regulatory mechanisms